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CHEMISTRY.—*The behavior of cystine dimethylester dihydrochloride and of cysteine monomethylester monohydrochloride in the Sullivan reaction for cysteine and cystine.* M. X. SULLIVAN, W. C. HESS, and H. W. HOWARD,[1] Georgetown University.

In a study of the defence mechanism of the animal body attention was given years ago to the sulphur system as exemplified by cystine and cysteine. For these compounds there was devised a test of remarkable specificity, directly for cysteine and indirectly for cystine, that is, after a preliminary reduction or cleavage of the disulphide bonds (1, 2, 3, 4). The procedure in testing for cystine is as follows: To 5.0 cc of solution containing 0.5 to 1.0 mg cystine and 0.1N with respect to hydrochloric acid add (A) 2.0 cc of 5 percent aqueous sodium cyanide, mix and wait 10 minutes, add (B) 1 cc of 0.5 percent aqueous 1,2-naphthoquinone-4-sodium sulphonate, mix by shaking for 10 seconds; add (C) 5.0 cc of 10 percent sodium sulphite in 0.5N sodium hydroxide, mix and let stand 30 minutes; add (D) 2.0 cc of 5N sodium hydroxide, mix and add (E) 1.0 cc of 2.0 percent sodium hyposulphite ($Na_2S_2O_4$) in 0.5N sodium hydroxide. The result is a vivid red-colored solution. In testing for cysteine, the cyanide added in step (A) is 1.0 cc of 1.0 percent sodium cyanide in 0.8N sodium hydroxide and the naphthoquinone is added immediately after mixing. The rest of the procedure is as for cystine. With hydrolysates containing material buffering against alkali the addition of the 5N sodium hydroxide before the hyposulphite is necessary, but in other cases it may be omitted.

In as much as a positive Sullivan reaction requires the cysteine structure and that the SH, NH_2, and COOH groups be free, it is of interest to compare the behavior of cystine dimethylester and cysteine monomethylester with the behavior of cystine and cysteine respectively. Measurements with these substances under a variety of conditions are described in the present paper.

Brand, Harris, and Biloon (6) from preliminary observations suggested that in the Sullivan reaction for cystine the methylester hydrochloride may develop more color than that produced by the equivalent amount of cystine.

Over a period of years we have found that cystine dimethylester dihydrochloride will give approximately 20 percent more color than cystine when the experiment is conducted on freshly prepared solutions in 0.1N hydrochloric acid using 2.0 cc of 5 percent aqueous sodium cyanide to open the disulphide bond and omitting the addition of the 5N sodium hydroxide. Similar results were obtained when the solution of the ester was kept at 5°C. over night. However, when the ester hydrochloride is allowed to stand at 25–30°C. in 0.1N hydrochloric acid for 4 hours or more it gives practically the same value as an equivalent amount of cystine, whereas, if the solvent is water there is little difference between freshly prepared solutions and those kept at room temperature over night. These points are illustrated by the data in Table 1.

When the agent employed to open the disulphide bond is 5 percent sodium cyanide dissolved in normal sodium hydroxide as used in our more recent work (5) the ester hydrochloride gives the same color value as

[1] The data in this paper were taken, in part, from the dissertation presented by H. W. Howard in partial fulfillment of the requirements for the degree of Doctor of Philosophy, Georgetown University. Received June 24, 1942.

an equivalent amount of cystine whether the ester is dissolved in 0.1N hydrochloric acid or in water and whether the solutions are freshly prepared or old, because the ester is saponified by the alkaline solution.

Fischer and Suzuki (7) early reported that the ester hydrochloride is rapidly saponified by alkali. They also observed a slight change of rotation when the ester hydrochloride was allowed to stand in aqueous solution. Abderhalden and Wybert (8), however, found no change in the optical rotation of the ethylester hydrochloride on standing 2 hours in water. As far as we have ascertained no one has hitherto tested the stability of the cystine dimethylester dihydrochloride in 0.1N hydrochloric acid. As shown in Table 1 this ester is saponified by 0.1N hydrochloric acid at room temperature in the course of 22 hours but in water it is not saponified appreciably during the same period.

TABLE 1.—THE PERCENTAGE COLORIGENIC VALUE OF CYSTINE DIMETHYLESTER DIHYDROCHLORIDE COMPARED WITH CYSTINE TAKEN AS 100 AT VARIOUS ACIDITIES

Age of Solution	Solvent			
	0.1N HCl	0.05N HCl	0.025N HCl	Distilled water
Freshly made	110	124	124	121
2 hours standing at room temperature	111	118	110	121
4 hours standing at room temperature	106	114	118	120
22 hours standing at room temperature	104	111	114	118
22 hours at 5°C.	121			

Since no reference to cysteine monomethylester hydrochloride could be found this compound was made from cysteine hydrochloride for comparison with cysteine.

One gram of cysteine hydrochloride was dissolved in 25 cc of anhydrous methyl alcohol and dry gaseous hydrogen chloride was passed into the solution for one hour with warming to 45°C. for the first 10 minutes. The solution was then poured into 500 cc of anhydrous ethyl ether, and the mixture was allowed to stand in the icebox for 48 hours. The cysteine methylester hydrochloride separated out in good yield as prisms. Since the ester was very hygroscopic it was warmed in a Schmiedeberg apparatus with methyl alcohol as the boiling liquid and was then transferred to a vacuum desiccator over sulphuric acid.

In a capillary tube the ester hydrochloride melted between 137 and 138.5°C. but softened at lower temperatures (110–130°C.). It is soluble in methyl alcohol and in water, slightly soluble in absolute ethyl alcohol and in acetic anhydride, insoluble in ethyl ether, petroleum ether, benzene, or acetone. Like cysteine it gave a red color with sodium nitroprusside and ammonia and a blue color with dilute ferric chloride. On analysis it gave the theoretical value for sulphur and nitrogen and 102 percent of the theoretical value for chlorine.

In the Okuda (9) method for cysteine, equivalent amounts of the cysteine monomethylester hydrochloride and cysteine hydrochloride gave the same titre, 0.95 cc of M/600 potassium iodate for 1.0 mg of cysteine. The Okuda method depends on the reactive (SH) so it does not indicate whether the methyl group had been split off at the acidity of the reaction, 2.0 percent hydrochloric acid. It may be said, however, that the ester dissolved in 2.0 percent hydrochloric acid saponifies very rapidly. After reduction with zinc and hydrochloric acid for 30 minutes at room temperature the titre of the ester was the same as before reduction and therefore no disulphide form was present.

The Sullivan method for cysteine, as early recommended (2), calls for the addition of 2.0 cc of 1.0 percent solution of sodium cyanide in 0.8N sodium hydroxide as an antioxidant and accelerator of the reaction. Using this alkaline cyanide the freshly prepared ester gave 102–105 percent as much color as an equivalent amount of cysteine because the alkalinity was sufficiently high to saponify the ester readily. In fact under these conditions the color generated was practically the same as that given by cysteine whether the test was made shortly after solution in 0.1N hydrochloric acid or after standing 22 hours.

On the other hand, when 2.0 cc of 5 percent aqueous sodium cyanide was used, as in the cystine test, the cysteine methylester hydrochloride in 0.1N hydrochloric acid gave 125 percent as much color as cysterine

treated in like manner. Again, with 2.0 cc of 1.0 percent aqueous sodium cyanide a freshly prepared solution of cysteine methylester hydrochloride in 0.1N hydrochloric acid gave 125–129 percent as much color as cysteine similarly treated. When the solution was kept at 5°C. for 22 hours, however, the color decreased to 118 percent, while kept at 25–30°C. it decreased to 115 percent. With the ester dissolved in water the colorimetric value compared with cysteine was 127 percent when tested immediately, and 125 percent when tested after 22 hours standing at room temperature.

SUMMARY

From the data it can be concluded that (1) both cystine dimethylester dihydrochloride and cysteine monomethylester monohydrochloride are saponified rapidly by cyanide dissolved in alkali to yield cystine and cysteine respectively; (2) the cystine dimethylester dihydrochloride is saponified by standing in 0.1N hydrochloric acid for 22 hours at room temperature, whereas, the monomethylester of cysteine is not appreciably saponified under similar circumstances; (3) the cystine dimethylester dihydrochloride is not saponified appreciably by 0.1N hydrochloric acid at 5°C. in the course of 22 hours; (4) in solutions of low acidity the cystine dimethylester dihydrochloride at room temperature is saponified much more slowly than in 0.1N hydrochloric acid; (5) both esters are relatively stable in aqueous solutions; (6) both the cystine dimethylester dihydrochloride and the cysteine monomethylester hydrochloride have a higher colorigenic value than cystine and cysteine respectively in the Sullivan reaction, when aqueous sodium cyanide is employed to cleave the disulphide or to act as an adjuvant in the cysteine reaction; (7) cystine dimethylester dihydrochloride gives practically the same value as cystine if sodium cyanide dissolved in normal sodium hydroxide is employed to cleave the disulphide; (8) cysteine monomethylester hydrochloride treated with 1.0 percent sodium cyanide in 0.8N sodium hydroxide gives the same value as cysteine; (9) the preparation and properties of cysteine monomethylester hydrochloride are described.

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PALEOBOTANY.—*A Miocene grapevine from the valley of Virgin Creek in northwestern Nevada.*[1] ROLAND W. BROWN, U. S. Geological Survey.

Leaves called *Vitiphyllum crassifolium* Fontaine and *Cissites parvifolius* (Fontaine) Berry and supposed to belong to species of the grape family (Vitaceae) have been described from the Lower Cretaceous formations of the Atlantic coastal region of Maryland and Virginia. If these leaves be regarded as correctly identified they place members of this family among the first dicotyledons to appear in the fossil plant records of the United States. Other specimens called *Ampelopsis*, *Cissus*, *Cissites*, and *Vitis* have been reported from the Upper Cretaceous and Paleocene of the Western Interior. Unmistakable seeds and leaves of grapes have been found from the Eocene onward both in America and Europe. Until now, however, no fossil wood of the Vitaceae has appeared in the United States, although three species have been described from Europe: *Vitoxylon coheni* Schuster (1911) from the Paleocene south-

[1] Published by permission of the Director, U. S. Geological Survey. Received July 7, 1942.

east of Rügen, Prussia; *Vitoxylon ampelopsoides* Schönfeld (1930) from the Miocene of southwestern Germany; and ?*Vitis* sp. Kräusel (1920) from the Miocene of Oppeln, Silesia.

The specimen described in this paper was donated to the National Museum in April, 1942, by Mark M. Foster, of Denio, Oreg. It came from a point about 300 feet within the main drift of the Rainbow Ridge Opal Mine located on Virgin Creek, a tributary of Thousand Creek in Humboldt County, Nev., and roughly 28 miles, as the crow flies, southwest of Denio. Photographs and a description of this locality were published by H. C. Dake (1933) and C. A. Reeds (1927), and the geology and paleontology of the region were described by J. C. Merriam (1907, 1910, 1911). According to Merriam the opal-bearing strata occur in the middle zone of a 3-parted sequence he called the Virgin Valley beds. These beds approximate 1,500 feet in thickness and have a low synclinal structure. They rest upon "Canon Rhyolite" below and terminate beneath a capping of "Mesa Basalt" above. The lower zone of the Virgin Valley beds comprises white to varicolored volcanic ash and tuff. The middle zone contains brown to gray clay and ash, diatomaceous beds, and thin-bedded carbonaceous shales with numerous lignitic layers. The upper and largest zone, chiefly of white, buff, and cream-colored ash and tuff, and some diatomaceous beds, rests, perhaps unconformably, upon the middle series.

In 1907 (p. 381) Merriam reported mammal remains as being common in parts of the lower and upper zones, and that only a few fragments of bones were found in the middle series. In 1910 (p. 30) and 1911 (p. 204), however, without a specific reference by way of retraction of his previous statement, he said that no mammal remains had been found in characteristic beds of the lower zone and only imperfect fragments in the upper zone, but that the principal fossil horizons fall within a stratigraphic interval of only a few hundred feet near the middle of the section. Dake, on the other hand, in 1933 (p. 17), presumably after visiting the area and recognizing Merriam's divisions, said that "the upper beds are soft in texture, of a light color, and carry an abundance of mammalian fossil remains." As the writer has not visited the region, he can offer no enlightenment on these contradictory statements. Both Merriam and Dake, nevertheless, are in agreement that the middle zone contains the precious opal, some fragmentary fossil leaves, and considerable fossil wood. On the basis of the mammalian remains vertebrate paleozoologists now assign the Virgin Valley beds to the upper half of the Miocene. The fauna appears to be older than that in the Mascall formation of Oregon and younger than that in the "Sheep Creek beds" of western Nebraska and eastern Wyoming (Stirton, 1939, p. 628).

VITACEAE

Vitoxylon opalinum Brown, n. sp.

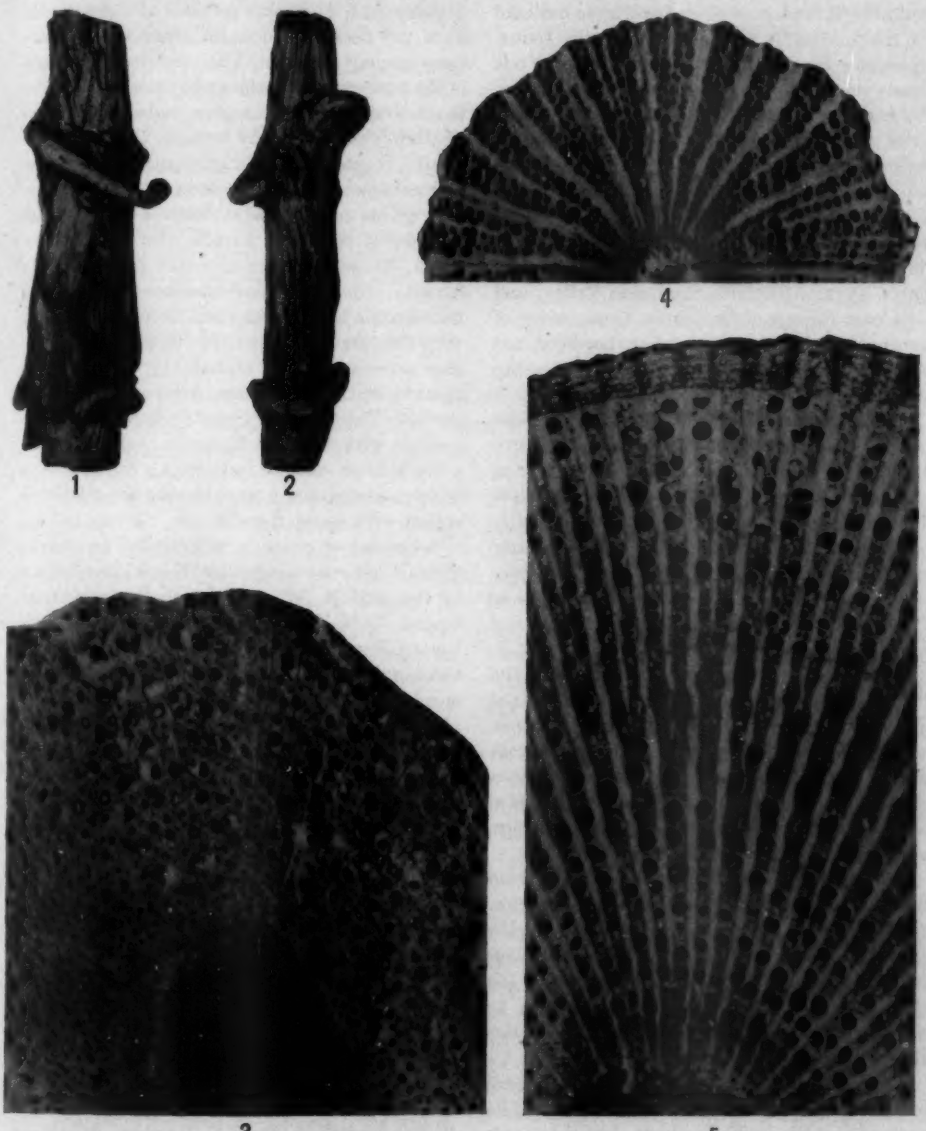
Figs. 1–3

The specimen is light-colored, 7 cm long and 1.3 cm in diameter. The surface of the woody cylinder, where it is not covered by thin lamellae of bark, is somewhat striated and furrowed longitudinally. At nodes 4.5 cm apart and separated by almost a half-turn around the stem emerge two sturdy tendrils or what perhaps may have been the basal portions of the peduncles of fruit clusters. These encircle the stem in a counterclockwise direction. No leaf scars remain at the points opposite the emergence of the tendrils.

The transverse section of the woody cylinder is shown in Fig. 3, magnified 14 times. The entire section is now elliptical because of distortion by pressure before fossilization, as shown by the oblong and irregular outlines of the pith and vessels in the left half of the figure. Normally, these should be approximately circular in cross-section. The pith and vessels are either replaced or filled by dark opal, but the remaining structures are of gray and somewhat softer opallike material that does not take as high a polish and reveals no cellular details. Rays are numerous and relatively narrow. Doubtless some of this narrowness is illusory and not exactly representative of the original width before the wood was distorted and opalized. Examined with a hand lens in just exactly the right light these rays appear much wider than the photograph indicates. In general, only one

radial row of vessels lies between adjacent rays. The vessels are arranged in 10 rings, suggesting an approximate age of 10 years for this portion of the vine. Because of the extensive opalization and obliteration of the finer cellular structures it was deemed futile to cut radial and tangential sections.

The bark, structure of the woody cylinder,



Figs. 1–3.—*Vitoxylon opalinum* Brown, n. sp.: 1, 2, Two views of the specimen to show emergence of the tendrils, natural size; 3, transverse section, ×14. Fig. 4.—Transverse section of *Parthenocissus quinquefolia*, ×14. Fig. 5.—Transverse section of *Vitis labrusca*, ×14.

and especially the tendrils characterize this specimen as a portion of a grapevine (*Vitis*). Inasmuch as comparable woody material from all the 60 living species of *Vitis* was not readily available, it is at present impossible to indicate the relationship of the fossil within the genus. Its narrow rays, however, suggest that it is not closely related to the fox grape (*V. labrusca*) of the Eastern United States. A section of the latter (Fig. 5) displays much broader rays and somewhat larger vessels. The native species of *Vitis* now living closest to the fossil locality are *V. arizonica*, which inhabits stream banks from western Texas to southeastern California, and *V. californica*, which grows in the western Sierra Nevada foothills, the Great Valley, and the Coast Ranges of California. Comparison of the fossil with these species has, however, not satisfied the writer that close relationship exists.

A transverse section (Fig. 4) of the Virginia-creeper (*Parthenocissus quinquefolia*), introduced for comparison, displays fewer and broader rays than species of *Vitis* and multiple instead of single rows of vessels between adjacent rays. In these respects the fossil is clearly aligned with *Vitis* rather than with *Parthenocissus*. Sections of *Ampelopsis* resemble those of *Parthenocissus* in having multiple rows of vessels between broad rays.

The species of *Vitis* are distributed in the Northern Hemisphere but are most abundant in temperate regions. The related genus *Ampelopsis* comprises 20 species in temperate North America and Asia. *Cissus*, with about 200 species, is found chiefly in tropical and subtropical regions, and *Parthenocissus*, with 10 species, inhabits temperate North America and Asia.

Vitoxylon opalinum is clearly different from the three described European fossil species. Schönfeld's *V. ampelopsoides*, as the specific name implies, is apparently allied to *Ampelopsis*. As for the other two, *V. coheni* and *?Vitis* sp., Schönfeld expresses some doubt as to whether they are correctly identified as Vitaceae.

The writer has not seen any of the fossil leaves said to have been found in the middle zone of the Virgin Valley beds, but they were reported by Merriam to be rushes, willows, and fragments of other species. Such wood as has not been completely replaced by opal and now included in the Virgin Valley opal collection in the National Museum is coniferous and belongs to the division normally without resin ducts. One specimen appears to be a species of *Sequoia*, but, as no thin sections of these woods have yet been cut, definite generic identifications can not be given. The presence of a grape in the flora suggests a somewhat moister climate than obtains in the region today, which is semiarid and practically treeless, the dominant woody vegetation being sagebrush with a few scattered junipers. Grapes are generally streamside plants usually in association with a fair mixture of trees and shrubs over which they climb. No wild grapes now live in Humboldt County, Nev. The carbonaceous shales and thin lignitic layers in the middle zone, together with the large amount of included fossil wood, also corroborate the probability of a moister climate at the time those sediments were deposited. The evidence from the fossil mammals accords with this hypothesis in that, although a few species seem to indicate an environment of open plains, some were clearly adapted to a region with wooded areas.

A species of grape is represented by leaves called *Vitis washingtonensis* (Knowlton) Brown in the middle Miocene Latah formation at Grand Coulee, Wash. A seed, called *Vitis bonseri* Berry, also from that locality, may be the same species. Associated with these grapes is a large number of other species—an assemblage indicating climatic conditions approaching those prevailing in the southeastern United States today. It may be postulated that if and when the associates of *Vitoxylon opalinum* from the Virgin Valley beds become known they will be found to be related to or perhaps identical with species from the Latah formation and of the fossil flora from Coal Valley, Nevada, now being studied by Axelrod (1940a, p. 163; 1940b, p. 480). These floras reflect the moister Miocene climate of the northern part of the Great Basin before the advent of more arid conditions in the Pliocene.

The writer is grateful to Dr. J. B. Reeside, Jr., of the Geological Survey, for supplying the specimen of *Parthenocissus quinquefolia;* to E. P. Henderson, of the U. S. National Museum, for petrographic examination of the fossil; and to N. W. Shupe, of the Geological Survey, for the excellent photographs.

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BOTANY.—*On new algae of the genus* Codium *from the South China Sea.*[1]

C. K. TSENG and WM. J. GILBERT, Department of Botany, University of Michigan. (Communicated by H. H. BARTLETT.)

When the senior author reported *Codium elongatum* C. Ag. from Hainan, China (Tseng, 1936, p. 170), he was not entirely without doubt. The plant so reported is similar to *Codium cylindricum* Holm. in general appearance, but the utricles are too small. It is similar to *Codium elongatum* in its utricles but differs in the divaricate branching and the short segments between the forkings. Since the materials available were sterile, he had to be content to place them with the widely distributed, rather variable *C. elongatum* of warmer waters.

Recently, the junior author was studying collections of *Codium* from the Philippines and was puzzled with a few specimens found to be very similar to the Hainan plants, which had been provisionally identified as *C. elongatum.* After the dried specimens from the two regions had been boiled to restore their natural conditions as nearly as possible, they were found to be similar in the size and form of the utricles. In some of the specimens, however, the utricles adhered to one another so closely that it was difficult to separate them. Others behaved like ordinary Codia with easily separable utricles. The coherent utricles of the one kind proved to be provided with conical, spinelike outgrowths, which were absent in the other. This and other differences convinced the authors that two species were involved, both still undescribed. Both are reported from Hainan Island, China, and the Philippines, in the northwestern and eastern parts of the South China Sea.

1. **Codium bartlettii** Tseng & Gilbert, sp. nov.

Figs. 1, 2a

Frons viridiuscula, unilateraliter subdichotoma, divaricata, ca. 17 cm alta; segmentis subcylindricis vel complanatis, cuneate dilatatis, ca. 1 cm latis, interdum hinc illinic inter se per tenacula adhaerentibus; filamentis medullae 30–60μ diam.; utriculis 100–360μ (generaliter 130–280μ) crassis, 600–1,100μ (generaliter 700–900μ) longis, subcylindricis vel clavatis, raro obovoideis, apice truncatis (Fig. 2a), membrana apicali paulum stratosa, ca. 5–10μ crassa; parietali tenuiore, 2–3μ crassa; pilis numerosis sub apicem utriculorum circulatim positis,

[1] Papers from the Department of Botany of the University of Michigan, no. 785. Received Feb. 27, 1942. This article was submitted to the Philippine Journal of Science for publication. Its receipt was acknowledged by the editor in June 1941. To date, however, the authors have not received any proof. The article has quite certainly not been published yet in Manila and, under the present circumstances, is most unlikely to be.

plerumque ca. 22–26μ latis, interdum solum 15μ, basi subconstrictis, plerumque ex vestigiis cicatriciformibus vel elevatis deciduis; gametangiis subfusiformibus, ca. 75–90μ latis, 270–320μ longis, supra mediam utriculorum, singulis vel binis, interdum utriculos excedentibus.

Specimen typicum: *H. H. Bartlett 13954*, ex loco dicto "Puerto Galera Bay," Mindoro, Insulis Philippinis, 12–17 Mai. 1935, in Herb. Univ. Michiganensi, ex profunditate ca. 12 ped. Specimina alia ex "Batangas Channel," Puerto Galera, Mindoro (*Bartlett 14015*) et Yuling-Kang, Hainan, Sina, Apr. 1934 (*Tseng 853*).

As in most of the branched Codia, the frond of *Codium bartlettii* appears to be many times subdichotomously branched. The forking, however, is unequal in that one side usually appears to be continuous with the axis below it and that the branches on the other side are less developed. These features result in mature fronds of characteristically unilateral appearance (cf. Fig. 1). The branching is divaricate, with very broad and roundish angles. As a rule, the lower the dichotomy, the more divaricate the branching. This species has the further peculiarity that segments of the same frond sometimes adhere to one another by means of tenacula of rhizoidal fibers (cf. Fig. 1). Knoblike protrusions are found on some segments. These, when examined microscopically, are also composed of rhizoidal filaments, and it appears that they are immature tenacula. Another characteristic is that the thallus of the new species is complanate, which is especially clear in the infra-axillary dilations. The young segments, however, are generally subcylindrical. The segments between the forkings are cuneate and short, generally 1–2 cm long; sometimes the segments are dilated at both ends and narrowed at the middle, thus assuming a dumbbell shape. The dilated part of the segments reaches a width of one centimeter. The frond gradually tapers upward and seems to be much elongated, since the type specimen, which represents only the upper portion of a plant, measures 17 cm.

Tseng 853 from Hainan is one of the two specimens formerly reported by the senior author (Tseng, 1936, p. 170) as "*Codium elongatum*." This specimen is young and sterile and does not show adherence of segments by rhizoidal fibers. There are, however, several knoblike protrusions, evidently immature tenacula, here and there on the segments. Similar knoblike protrusions are also found in the type specimen. The important characteristics of the Hainan plant agree so well with the Philippine specimens that the authors do not feel any hesitation in referring it to the same species.

Codium bartlettii is a member of the section *Elongata* De-Toni, probably nearest to *C. elongatum*, which is presumed to be widely distributed in warmer and tropical seas. The latter plant (C. Agardh, 1822, p. 454; Setchell, 1933, p. 188, pl. 26, fig. 2; pl. 29, fig. 3) resembles the present species in the infra-axillary dilations of the thallus, the cuneate segments, and the size and form of the utricles. The unilateral and broadly divaricate branching, the much shorter segments, and the much smaller gametangia, however, differentiate it clearly from *C. elongatum*. The next species that should be compared with the present one is *C. cylindricum* (Holmes, 1895, p. 250, pl. 7, figs. 1a, b; also cf. Okamura, 1915, p. 177, pl. 141), which is found abundantly on the coast of Kwantung and Fukien Provinces, China, in the northern part of the South China Sea. In its general aspect *C. cylindricum* is similar, especially certain forms with strong infra-axillary dilations and divaricate branching. It has, however, much longer segments between the forkings, does not have the characteristic unilateral branching even in mature specimens several meters long, has much larger and longer utricles (as much as 900μ in diameter and 2 mm long), which are plainly visible to the naked eye and have differently shaped, somewhat broader gametangia. Also resembling the new species in the divaricate branching and the shape and size of the utricles is *C. divaricatum* Holmes (1895, p. 250, pl. 7, figs. 2a, b; also cf. Okamura, 1915, p. 155, pl. 136), reported from Japan and North China. That species, however, is a much larger, darker colored, and very tough plant, with much longer segments between the forkings, which has mature utricles with rounded, convex apices, very much thickened (up to 60μ) clearly stratified apical membranes, and somewhat differently situated and larger gametangia (180μ in diameter and 450μ long).

The only species reported to have unilateral branching is *C. unilateralis* Setchell & Gardner (1924, p. 710, pl. 15, figs. 30, 31; pl. 36) from

the Gulf of California. That species, however, is cylindrical, with much narrower segments, and has very narrow angles of branching and much broader gametangia. Another species of the same alliance is *C. cuneatum* Setchell & Gardner (1924, p. 708, pl. 16, figs. 34, 35; pl. 34) also from the Gulf of California, which has short cuneate segments, flattened thallus, utricles of similar shape and size, and subfusiform gametangia. It has, however, an entirely different type of branching, being regularly dichotomous-flabellate, with much narrower angles of forking, much broader,

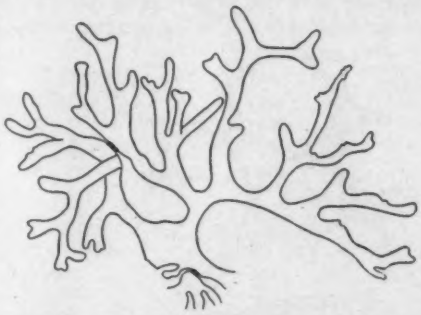

Fig. 1.—*Codium bartlettii* Tseng & Gilbert, sp. nov.: Habit sketch of a part of the type, showing especially the intersegmental cohesion by tenaculae and the unilateral branching, ×0.4.

cuneate segments, and broader and shorter gametangia.

From all the more or less closely related species, the new one differs additionally in the peculiar ability of the segments to fuse with one another by means of tenacula of delicate rhizoidal fibers growing out from the thallus. This is apparently a result of growth stimulated by the contact of the segments. The phenomenon is not at all common among members of the section *Elongata* De-Toni, being reported, so far, in only two other species. These are *C. intricatum* Okamura (1915, p. 74, pl. 120, figs. 9–13) and *C. coarctatum* Okamura (1915, p. 141, pl. 134, figs. 4–12), both originally described from Japan and the first one later found in the Loochoo Islands and Hainan. The senior author has seen hundreds of living specimens of *C. cylindricum*, *C. divaricatum*, and others of similar habit with segments frequently overlapping one another but has never found similar cases of anastomosis by tenacula. It seems, therefore, to be peculiar to certain species, notably members of the *repens* group of the section *Tomentosa* De-Toni. *C. bartlettii*, although resembling *C. intricatum* and *C. coarctatum* in the possession of intersegmental tenacula, differs definitely from both species in many respects. These latter are small, low-creeping plants with irregular branching, which, although also divaricate, has much narrower angles of forking and is never unilateral. In *C. intricatum* the segments between the forkings are not so distinctly flattened and cuneate, and the gametangia are generally ovate rather than elongate-subfusiform as in *C. bartlettii*. *C. coarctatum* has a strongly flattened thallus, which is, however, dorsiventral, with much narrower utricles (50–60μ).

2. **Codium papillatum** Tseng & Gilbert, sp. nov.

Figs. 2, b–d, 3

Frons viridis, subdichotoma, saepe irregularis, ut videtur unilateralis vel alternatim ramosa, si furcata, ramis alterutris inaequalibus, divaricata, ca. 8 cm alta, parte basali discoidea ad substratum affixa (cf. Fig. 3); segmentis junioribus subcylindricis, vetustioribus complanatis, segmentis inferioribus inter bifurcationes sursum dilatatis, brevioribus quam latioribus (ca. 7 mm latis, plerumque 2–5 mm longis); infimis stipitiformibus parvissimis, sequentibus usque ad frondis mediam gradatim grandioribus, superioribus aliquantalum parvioribus; apicalibus elongatis, flagelliformibus sursum plus minusve tumidis; filamentis medullariis 30–60μ diametientibus; utriculis papillatis, 100–300μ (generaliter 140–240μ) latis, 600–900μ (generaliter 650–850μ) longis, subcylindricis vel obovoideis, apice truncatis vel subtruncatis, membrana parietali tenui, 2–3μ crassa, apicali leviter foveolata, ca. 10–20μ crassa (cf. Fig. 2, *d*); papillis solidis late conicis, 10–16μ latis, 8–10μ altis, apice obtusis vel acutiusculis (cf. Fig. 2, *b*, *c*); pilis numerosis sub apicem utriculorum cyclice positis, ca. 25–30μ crassis, basi saepe constrictis, caducis, delapsu cicatrices rotundas vel semilunares vel elevatas formantibus; gametangiis ellipsoideis vel ovoideis, plerumque ca. 70–90μ latis, 200–270μ longis, saepissime singulis, interdum binis, raro trinis supra mediam utriculorum positis.

Specimen typicum: *H. H. Bartlett 13786*, ex "Puerto Galera Bay," Puerto Galera, Mindoro,

Insulis Philippinis, 12–17 Mai, 1935, in Herb. Univ. Michiganensi. Specimina alia ex Cavite, Cavite Prov., Luzon, Insulis Philippinis, Jul. 1935 (*Bartlett 14595a*).

Only a few specimens are available. The materials are fortunately in good fruiting condition, and can be well compared with other related species. Two specimens in the type collections and also *Bartlett 14595a*, are larger than the actual type specimen, being about 8 cm high and 7 mm broad in the dilated parts of the segments. In general appearance and internal characteristics, however, they agree well with the type.

The present plant was first thought to be only a small form of the previous species, namely, *Codium bartlettii*. Further studies revealed the important characteristic presence of the papilliform outgrowths of the utricles. So far as the information of the authors goes,

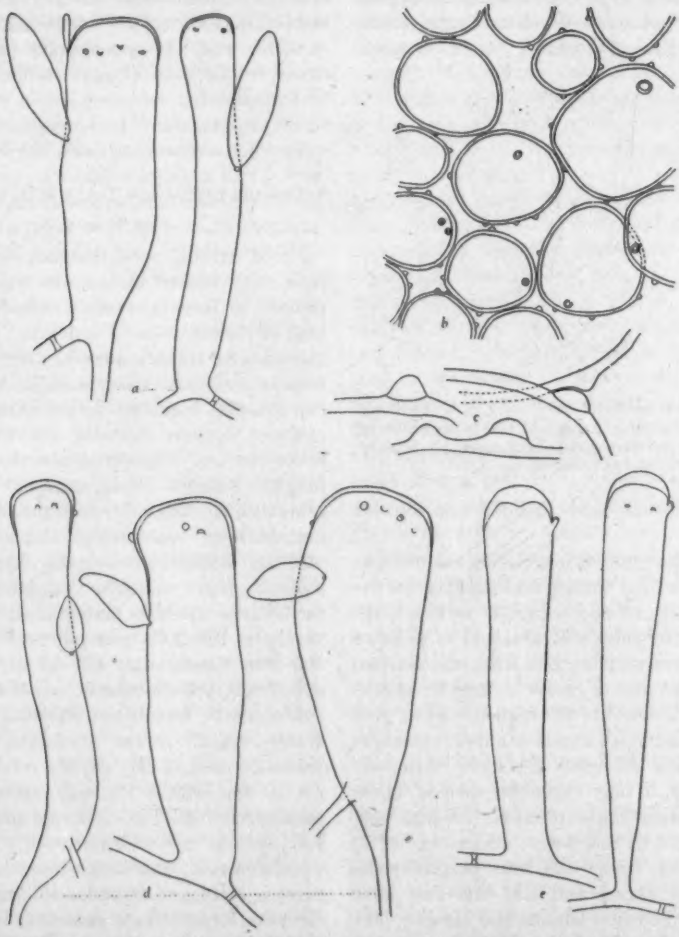

Fig. 2.—(*a*) *Codium bartlettii* Tseng & Gilbert, sp. nov.: Two utricles showing a hair, several hair-scars, and two gametangia. ×80. (*b–d*) *Codium papillatum* Tseng & Gilbert, sp. nov.: *b*, Vertical view of some utricles with the conical papillae, ×64; *c*, some utricular papillae, ×358; *d*, three utricles showing some papillae and hair-scars, and three gametangia, ×64. (*e*) *Codium papillatum*, var. *hainanense* Tseng, var. nov. Two utricles showing hair-scars and the thickened apical membranes, ×64.

such utricular papillae have never been reported before. As mentioned above, the plant is extraordinary in that the utricles adhere to each other quite firmly and are separated with difficulty. If an attempt is made to separate them, the upper portion of the utricles generally breaks away from the lower. When thus broken, mounted and examined microscopically, a vertical view of the utricles, rather than a lateral view, was obtained, giving the clearest view of the papillae (cf. Fig. 2*b*). These are merely outgrowths from the cell wall of the utricles and have no connection with the cytoplasm whatsoever (cf. Fig. 2*c*). They are found mostly somewhere below the apices of the utricles, sometimes at the tips, and occasionally very low down on the side walls of the utricles.

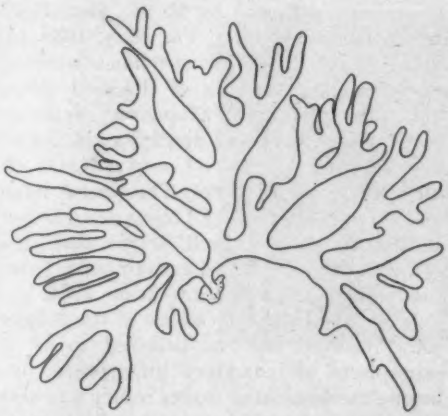

Fig. 3.—*Codium papillatum* Tseng & Gilbert, sp. nov.: Habit sketch of the type, showing the branching, ×0.7.

The present species is a member of the section *Elongata* De-Toni, probably nearest to *C. bartlettii* described above, which it resembles in the divaricate branching, the somewhat cuneate, short, flattened segments between the forkings, and the size and shape of the utricles. The absence of tenacula, the smaller size of the frond and segments, the much thicker, sometimes foveolate apical ends of the utricles, and the different shape of the much shorter gametangia, besides the presence of the characteristic papillae on the utricles, separate it easily from the first described new species. From the widely distributed *C. elongatum* it differs in the divaricate branching with short segments between the forkings, the foveolate, thickened apical membrane of the utricles, the utricular papillae, and the smaller, somewhat differently shaped gametangia. The divaricate branching and the thickened apices of the utricles remind one of *C. divaricatum* of Japan and North China. That species, however, is a much larger and tougher plant which has the segments between the forkings several times as long, the apical membranes of the utricles three to four times as thick, and the gametangia much larger and differently shaped.

2a. **Codium papillatum** Tseng & Gilbert, var. **hainanense** Tseng, var. nov.

Fig. 2*e*

Frons subdichotoma, divaricata, ca. 10 cm alta, segmentis junioribus subcylindricis, segmentis vetustioribus complanatis, infra axillas cuneate dilatatis, ca. 1 cm latis; utriculis papillatis, 150–300μ latis, 650–950μ longis, subcylindricis vel obovoideis, apice truncatis vel subtruncatis, membrana apicali leviter foveolata, ca. 15–30μ crassa; pilis numerosis sub apicem utriculorum positis, ca. 25–30μ latis. Gametangia ignota.

Specimen typicum: *Tseng 771*, ex Tsinglan-Kang, Wenchang, Hainan, Sina, 7 Apr. 1934, in Herb. C. K. Tseng.

Var. *hainanense* is a much larger and more robust plant than the nomenclatorial typical form of the species with respect to the height of the frond, the breadth of the segments, and, to a lesser extent, the size of the utricles. The apical membrane of the utricles is much thicker and more clearly stratified and foveolate. The papillae, however, are not so abundant, and the coherence of the utricles not so firm as in the typical form. The specimen *Tseng 771*, upon which the new variety is based, was reported under "*Codium elongatum*" (pro parte) by the senior author (Tseng, 1936, p. 170). Although the material available is sterile, the plant agrees well with the species to which it is referred in the important characteristics, e.g., the behavior of the utricles, the utricular papillae, the apical thickening of the sometimes foveolate apical membrane of the utricles, the form and size of the utricles, and the divaricate branching of the frond. Differing, however, from the typical form in the few points already mentioned, it is described as a new variety.

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BOTANY.—*An undescribed* Atropellis *on cankered* Pinus virginiana.[1]

M. L. LOHMAN, EDITH K. CASH, and ROSS W. DAVIDSON, Bureau of Plant Industry. (Communicated by JOHN A. STEVENSON.)

Two species of *Atropellis* have been reported (3) as occurring in association with cankers of scrub pine, *Pinus virginiana* Mill., in the Allegheny and Appalachian forest areas. The commoner of the two, *Atropellis tingens* Lohm. & Cash, is known to occur on various species of pines, native and exotic, in natural stands or plantings from New England to Florida, Ohio, and Arkansas. The other, *A. piniphila* (Weir) Lohm. & Cash, a species typically of the Rocky Mountain area and presumably very infrequent in the Southeastern States, is recorded but once for this host and once for loblolly pine, *P. taeda* L. The cankers due to these two fungi on various hosts are discussed briefly by Boyce (1). That due to *A. tingens* is described more fully by Diller (2).

It is in association with a similar canker that there has been found on scrub pine in Virginia and North Carolina a third and undescribed species of the genus, peculiarly interesting because of its rather atypical ascospores and the fact that it colors the test solution (5 per cent KOH) chocolate-brown rather than the greenish blue or bluish brown characteristic of the other species of *Atropellis* occurring on pines (2, 3). While no inoculations have been made, it is reasonable to assume that the fungus is pathogenic in view of its constant association with cankers and discolored wood as in the case of the previously mentioned species.

What appears to be the earliest record is a specimen collected by R. W. Davidson, in Shenandoah County, Va., May, 1933. In June and July, 1933, five specimens were received among samples of diseased pines from the George Washington National Forest, New Kent and Spotsylvania Counties, Va., and Alamance County, N. C., all collected by J. D. Diller. The fungus later was noted in the field by Lohman and Diller in Buncombe, McDowell, Davie, and Forsyth Counties, N. C., at various times from the following September to June, 1934.

When the early collections of the fungus were received, it was believed to be a saprophyte of secondary importance, following mechanical or insect injury and also following cankering due to *Atropellis tingens*. In 1940, however, in the study of specimens currently collected by Diller in Goochland County, Va., the fungus was obtained in culture from ascospores and the general similarity in cultural characteristics between it and *A. pinicola* Zell. & Goodd. and *A. tingens* was demonstrated. Except for the lack of production of the *Atropellis* conidial (? spermatial) stage, which, however, likewise is lacking in all of the specimens among collections received to date, the general characteristics of the fungus are in agreement with those previously reported for ascospore cultures of *A. arizonica* Lohm. & Cash and for a number of cultures of *A. tingens* isolated from the colored infected wood of various species of pines (3).

Cultures were made from the discolored wood and from ascospores that had been

[1] The work of the present account, in part, and that incorporated in a previous account on *Atropellis* (3), in connection with which the studies herein reported were initiated, are credited to the Civilian Conservation Corps and to the Division of Forest Pathology and the Division of Mycology and Disease Survey in cooperation. Received July 6, 1942.

induced to shoot out onto the surface of corn meal agar in petri dishes. The cultures from these two sources were similar in rate of growth and general appearance. Both gave a brown reaction ("old gold" to "Hessian brown")[2] when particles of 3-month-old mycelium were placed in dilute KOH solution. On malt agar medium the mycelial mats were erumpent, black and uneven, of slow growth and with scattered or marginal areas of fine, gray tomentum. (Cf. 3, fig. 1, A, B.)

Most of the ascospores developed one or two septa on germination (Fig. 1, D). The germ tubes, both lateral and terminal, developed and grew slowly when the test plates were held in the refrigerator at a temperature of about 11°C. No conidia were found in cultures grown for three months, in which respect they differ from comparable cultures of *Atropellis tingens*.

This fungus agrees with the four canker-forming species previously described (3), namely, *Atropellis arizonica*, *A. pinicola*, *A. piniphila*, and *A. tingens*, with respect to all features of generic importance. It is in particularly close agreement with *A. arizonica* in having relatively small apothecia, about 2 mm in diameter, and fusoid, more or less subsigmoid spores; with *A. piniphila* in the blackish-brown exciple and size of ascospores; and is more like *A. tingens* with respect to ascus measurements. On the other hand, in comparison with these four species it is distinct in the somewhat lighter colored hymenium, as seen in expanded ascocarps, the sharply pointed to apiculate ascospores, and in the apparent lack of a similar conidial stage; also, in the brownish epithecium which, relative to its development, is largely responsible for the resultant rich brown color given by the KOH test. Of these features, the characteristic shape of the ascospore is utilized in naming this species.

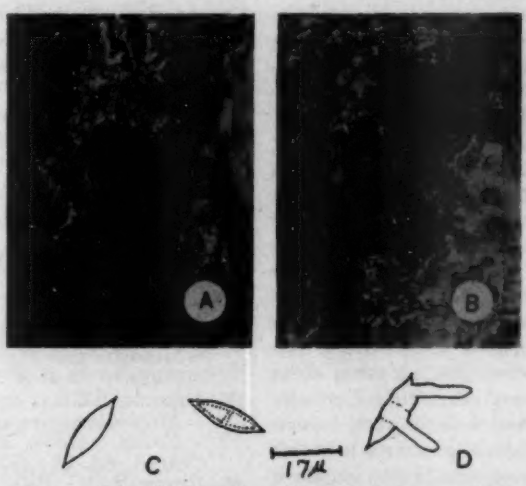

Fig. 1.—*Atropellis apiculata* on *Pinus virginiana*: A, closed, B, partly opened apothecia, ×10; C, ascospores outlined with the aid of the camera lucida; D, germinating ascospore.

Atropellis apiculata, sp. nov.
Fig. 1, A-D

Apotheciis ex cortice erumpentibus, sessilibus vel substipitatibus, plus minusve aggregatis, coriaceis, atro-fuscis, 1.5–2 mm diam., subglobosis dein expansis, patelliformibus dein exaridis hysteriformibus, aliis triangulis atque irregulariter compressis; margine undulato, laciniato, incurvato; hymenio pruinoso, cinnamomeo vel atro-fusco; ascis cylindrico-clavatis, apice obtusis, 8-sporicis, 80–110μ longis, 10–12μ latis; ascosporis hyalinis, fu-

[2] Quoted color terms are from Ridgway (4).

soideis, subsigmoideis, apiculatis, 1-2-septatis, 20–24μ longis, 4.8–6.5μ latis, apicibus (2–3 μ longis) inclusis; paraphysibus filamentosis, septatis, ramosis, apice brunneolis, conglutinatis; hypothecio pallide brunneo; strato interiore subhyalino; cortice crasso, atro, exterius rugoso; statu conidico in natura et culturis indeprehenso.

Hab. in cortice ramorum vivorum *Pini virginianae.*

Apothecia emerging from the bark over cankered areas, scattered or in more or less dense groups, coriaceous, sessile or substipitate, subglobose, then expanded and patellate, 1.5–2 mm in diameter, with lacerate, undulate margin, inrolled on drying, then hysteriform, triangular, or irregularly compressed, furfuraceous, dark brownish ("blackish brown" to "fuscous-black"); hymenium pruinose, light to dark brown or nearly black ("dark vinaceous-drab" to "raisin black" and sometimes lighter, "pinkish buff" or "cinnamon-rufous"); asci cylindric-clavate, gradually attenuated toward the base, broadly rounded to slightly flattened at the apex, 8-spored, 80–110 × 10–12μ; spores hyaline, fusoid to subsigmoid with sharply pointed or apiculate ends, biseriate above, irregularly uniseriate below, continuous with granular contents, at last 1-septate or more rarely 2-septate, unconstricted, 20–24 × 4.8–6.5μ, including the apiculae, 2–3μ in length; paraphyses filamentous, septate, branched, slightly swollen at the apex, becoming granular incrusted and forming a brownish epithecium which in age breaks into islands or tufts that tend to break away; hypothecium of pale brown, fine, densely interwoven hyphae; medullary layer 100–150μ thick, subhyaline, appearing loose in hyphal structure; cortex about 50μ thick at the margin and 200μ at the base, of compacted, black, thick-walled, closely septate hyphae which on the surface build hyphal clumps that give the exciple a furfuraceous appearance.

On cankered twigs and small branches and on main stems of seedlings of *Pinus virginiana* Mill. in Virginia and North Carolina, probably widespread but infrequent.

Specimens examined.—VIRGINIA: Shenandoah County, May 25, 1933, R. W. Davidson (F. P. 66206); Goochland County, June 23, 1933, J. D. Diller 75 (F. P. 66204) and July 25, 1940, J. D. D. 1002 (F. P. 94036); New Kent County, June 20, 1933, J. D. D. 29-A (F.P. 66208) and July 25, 1940, J. D. D. 1003 (F. P. 94034); Spotsylvania County, June 23, 1933, J. D. D. 71 (F. P. 66207) and July 25, 1940, J. D. D. 1001 (F. P. 94035, *type*); George Washington National Forest, July, 1933, J. D. D. 213-A (F. P. 66209). NORTH CAROLINA: Alamance County, June 28, 1933, J. D. D. 123 (F. P. 66205).

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ENTOMOLOGY.—*New species of* Anastrepha *and notes on others (Diptera, Tephritidae).*[1]

ALAN STONE, Bureau of Entomology and Plant Quarantine.

As was expected when work was terminated on the writer's revision (7)[2] of the genus *Anastrepha*, several new species have since come to light. The present paper is designed to describe these new species and to publish additional information of interest concerning others. Some of this material is from the continued active collecting of James Zetek, while the species from Venezuela and British Guiana were submitted by Pablo Anduze and J. N. Knull, respectively.

There has been some confusion concerning the correct family name for the fruit flies commonly known as Trypetidae. The essential facts that led to the adoption in this paper of the little-used name Tephritidae are as follows: Until very recently the writer was not aware that the name Trypetidae was not the first name used for the

[1] Received June 20, 1942.
[2] Numbers in parentheses refer to literature cited at the end of the paper.

family, so that when *Trypeta* Meigen fell as a synonym of *Euribia* Meigen [see Stone (6, p. 410)] it seemed necessary to change to the name Euribiidae. It now appears that the name Trypetidae was not used until 1862 by Loew (2, p. 49), whereas Newman in 1834 (5, p. 396) introduced the name Tephritites as a "Natural Order" under the Stirps Muscina, and based on the genus *Tephritis*. In 1835 Macquart (3, p. 447) used the name Tephritidae as the name of a "sous-tribu," and other workers such as Bigot, Walker, Frey, and Hendel have used it since then. Since it is desirable, if not mandatory, to follow priority in family names, and since the well-established name of Trypetidae must be dropped if we consider a synonym not available as the basis of a valid family name, it appears advisable to accept the family name Tephritidae. The only other possibility would be the name Trupaneidae, arrived at either by basing the family name on the name of the oldest included genus or by sinking *Tephritis* as a subgenus of *Trupanea*. The former procedure, mentioned (by citation of the name Trypaneinae), but not accepted, by Hendel in 1910 (1, p. 311), would not be sanctioned by the International Commission of Zoological Nomenclature in this case (opinion 133), whereas the latter, although suggested by Malloch in 1931 (4, p. 276), is not sound from a taxonomic standpoint.

Anastrepha gigantea, n. sp.
Figs. 4, 8

Very large, yellow-orange. Clypeal ridge strongly protuberant, with no median depression. Mesonotum 5.0 mm long, orange, with humerus, lateral stripe from transverse suture to scutellum, very slender median stripe fading out posteriorly, and scutellum paler; pleura mostly pale yellowish; metanotum entirely yellow orange. Macrochaetae black; pile yellow orange. No sternopleural bristle. Wing 13.5 mm long, the band along costa yellow orange, the other bands brownish; costal and S-bands joined from anterior margin of wing to cell R_1, the hyaline band only very faintly indicated in cells R_1 and R_{2+3}; V-band complete and broadly joined to S-band anteriorly; vein R_{2+3} slightly undulant; vein M_{1+2} curved forward to meet apex of S-band. *Female terminalia:* Ovipositor sheath 9.4 mm long, tapering from base to short distance beyond spiracles and then nearly parallel-sided to apex; spiracles about 1.8 mm from base. Rasper of rather large hooks in several rows. Ovipositor about 9.0 mm long, with a slight lateral swelling beyond end of oviduct but no distinct serrations.

Type material.—Holotype, female (U.S.N.M. no. 56317).

Type locality.—El Cermeño, Panamá.

The single specimen was trapped by James Zetek, February 6, 1940. This, the largest known *Anastrepha*, will fit into neither half of the first couplet of the writer's key to species. Among the species with a swollen clypeal ridge it is nearest to *benjamini* Lima, but it is quite distinct in wing pattern and terminalia.

Anastrepha doryphoros, n. sp.
Figs. 7, 14

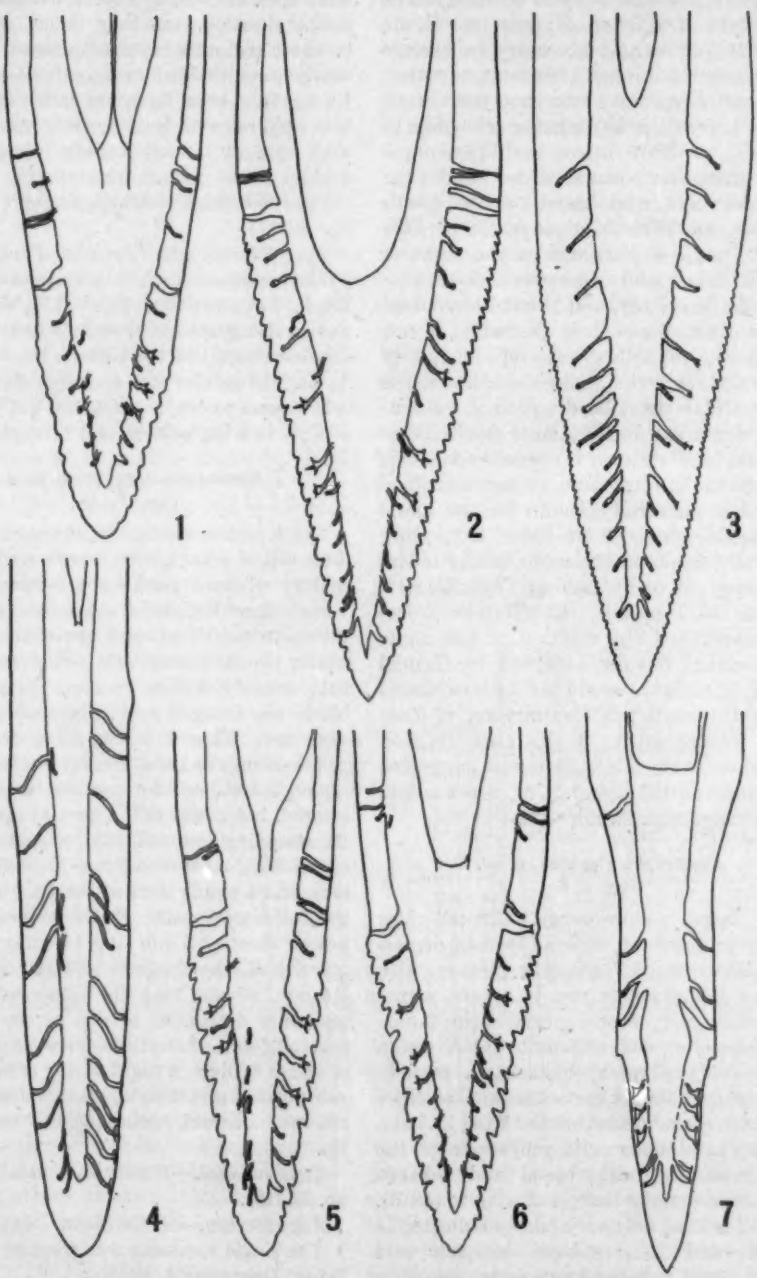
Large, yellow-orange. Mesonotum 3.7 mm long, yellow orange, with narrow median stripe slightly widened posteriorly, border of transverse suture, sublateral stripe from transverse suture to scutellum, and scutellum yellowish white; pleura mostly pale yellowish; metanotum entirely yellow orange. Macrochaetae black; pile orange-brown. Sternopleural bristle very fine. Wing 10.0 mm long, the pattern yellow-orange on basal-anterior portion, brownish on apical-posterior portion; most of wing colored, but costal cell, a spot at apex of vein R_1 extending into cell R_{2+3}, a spot near base of cell R_{4+5}, most of cell 2nd M_2, cell M_1, anal lobe, and a poorly defined band across cell Cu_1 hyaline or subhyaline. *Female terminalia:* Ovipositor sheath 9.0 mm long, tapering to slender apical half, the spiracles 1.65 mm from base. Rasper 1.07 mm long, the hooks rather small, gradually decreasing in size basally; tip 0.32 mm long, with abrupt constrictions just distad of end of oviduct, a slight flaring to base of serrate portion, and then tapering to apex, the serrations indistinct, occupying less than half of tip.

Type material.—Holotype, female (U.S.N.M. no. 56318).

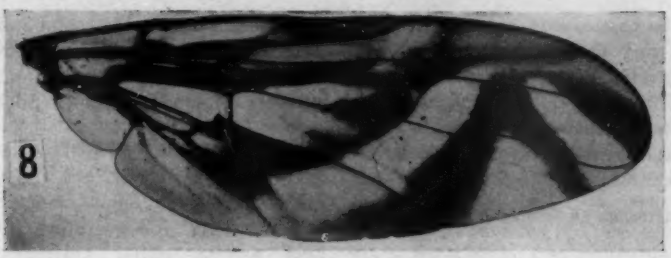
Type locality.—El Cermeño, Panamá.

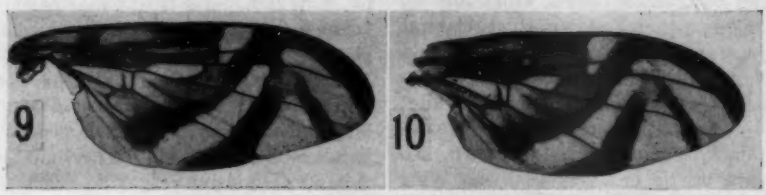
The single specimen was trapped by James Zetek, December 5, 1939.

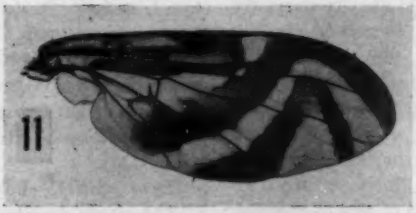
This species goes to couplet 19 in the writer's

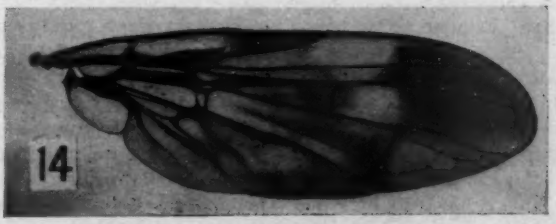


Figs. 1–7.—Ovipositor tips of new species of *Anastrepha:* 1, *teli;* 2, *anduzei;* 3, *dryas;* 4, *gigantea;* 5, *parishi;* 6, *guianae;* 7, *doryphoros.*









Figs. 8–14.—Wings of new species of *Anastrepha:* 8, *gigantea;* 9, *parishi;* 10, *teli;* 11, *dryas;* 12, *anduzei;* 13, *guianae;* 14, *doryphoros.*

key, but can be carried no further because of the atypical wing pattern with no distinct S-band. The relationship of this species is not at all clear. The rather elongate rasper somewhat resembles that in *ballowi* Stone, but the wing pattern and ovipositor tip are unlike those of any other species known to the writer.

Anastrepha anduzei, n. sp.
Figs. 2, 12

Medium sized, yellow-brown; mesonotum 2.5–3.6 mm long, yellow brown, with humerus, median stripe expanding posteriorly, sublateral stripe from transverse suture to scutellum, and scutellum yellowish white; pleura above, including all of metapleuron, yellowish white; metanotum entirely yellow-orange. Macrochaetae black, pile pale, yellow-brown. No sternopleural bristle, or a very weak one. Wing 6.5–8.5 long, the bands yellow-brown; costal and S-bands rather broadly connected along vein R_{4+5}, V-band complete, usually narrowly joined to S-band anteriorly. *Female terminalia:* Ovipositor sheath 2.5–2.7 mm long, rather stout, tapering apically, the spiracles about 0.5 mm from base. Rasper of medium-sized, rather compressed hooks in four or five rows. Ovipositor 2.2–2.4 mm long, rather stout, the base distinctly widened, the tip finely serrate from acute apex to a point basad of end of oviduct; width at base of serrate portion more than half distance from apex of ovipositor to end of oviduct. *Male terminalia:* Tergal ratio about 1.0; clasper about 0.34 mm long, stout basally, flattened apically, tapering to an acute apex; teeth at or near middle; a distinct postero-lateral swelling at level of teeth.

Type material.—Holotype, female (U.S.N.M. no. 56319); paratypes, 90 females, 77 males U. S. National Museum and Museo Nacional de Ciencias, Caracas, Venezuela).

Type locality.—San Estaban, Carabobo, Venezuela.

Distribution.—State of Carabobo, Venezuela.

The holotype and 13 paratypes were collected at San Esteban, November 22 to 30, 1939, and the remaining paratypes at San Esteban from December 1, 1939, to January 7, 1940, and at Puerto Caballo, on January 13, 1940, by Pablo Anduze, for whom the species is named.

In the writer's key this species would run to *lutzi* Costa Lima in couplet 71, but it differs from *lutzi* in having the costal and S-bands of wing much more broadly connected, in having distinct pale stripes on mesonotum, and in having sides of ovipositor tip less angulate.

Anastrepha parishi, n. sp.
Figs. 5, 9

Medium sized, yellow-orange. Mesonotum 3.25 mm long, yellow-orange, with an indistinct median stripe widening posteriorly, humerus, lateral stripe from transverse suture to scutellum, and scutellum paler; pleura yellow-brown, brighter yellow just below notopleuron; metanotum entirely yellow-orange. Macrochaetae orange brown; pile pale yellowish. No sternopleural bristle. Wing 7.5 mm long, the bands yellow brown; costal and S-bands connected at vein R_{4+5}; V-band joined to S-band anteriorly; vein M_{1+2} nearly reaching apex of S-band. *Female terminalia:* Ovipositor sheath 2.7 mm long, the spiracles about 0.95 mm from base. Rasper of moderate sized hooks in a compact mass of 7 or 8 rows. Ovipositor 2.5 mm long, rather slender, the base slightly widened, the tip 0.26 mm long, tapering, with about 10 rather flat teeth on each side.

Type material.—Holotype, female (U.S.N.M. no. 56320).

Type locality.—Bartica, British Guiana.

The single specimen was collected by H. S. Parish, August 20, 1901. I take great pleasure in naming the species in honor of its collector.

This species would run to *irretita* Stone in couplet 84 of the writer's key, but differs in having the serrations of the ovipositor tip beginning nearer the apex of the oviduct, and in having the V-band of the wing joined to the S-band anteriorly.

Anastrepha teli, n. sp.
Figs. 1, 10

Medium sized, yellow-orange. Mesonotum 3.0–3.5 mm long, yellow-orange, with narrow median stripe widening posteriorly to include the acrostichal bristles, humerus, and lateral stripe from transverse suture to scutellum yellowish white; usually an indistinct dark spot on scuto-scutellar suture; pleura pale yellowish; metanotum entirely yellow orange. Macrochaetae nearly black; pile brownish, paler on median stripe. Sternopleural bristle very weak or absent. Wing 7–8 mm long, the bands orange

to brown; costal and S-bands connected on vein R_{4+5}; V-band complete, separated from S-band. *Female terminalia:* Ovipositor sheath 2.68–3.0 mm long, the spiracles about 1.0 mm from base. Rasper of moderate sized hooks in about 6 rows. Ovipositor 2.4–2.6 mm long, rather stout, the tip 0.22–0.28 mm long, tapering to a rather blunt apex, with about 10 inconspicuous rounded serrations on scarcely more than apical half.

Type material.—Holotype, female, paratypes, 3 females (U.S.N.M. no. 56321).

Type locality.—El Cermeño, Panamá.

Distribution.—Panamá.

The holotype was trapped at the type locality October 17, 1939, by James Zetek. Two topotypes were trapped December 12, 1939, and February 6, 1940. The third paratype was trapped at La Campana, Panamá, December 14, 1938.

This species runs to *irretita* Stone, in couplet 84 of the writer's key, but the ovipositor tip is not angulate at the base of the serrate portion and the serrations are shallower. It differs from *parishi* in having the serrations begin considerably farther from the apex of the oviduct, and in having the V-band of the wing separated from the S-band.

Anastrepha guianae, n. sp.
Figs. 6, 13

Medium sized, yellow-brown. Mesonotum 3.36 mm long, yellow-brown, with humerus, median stripe widening posteriorly to include the acrostichal bristles, lateral stripe from transverse suture to scutellum, and scutellum paler yellow; pleura mostly pale yellowish; metanotum narrowly darkened laterally. Macrochaetae rather dark orange-brown; pile pale yellow. Sternopleural bristle rather strong, yellow brown. Wing 7.5 mm long, the bands yellow brown; costal and S-bands rather broadly connected at vein R_{4+5}; V-band complete, very narrowly joined to S-band anteriorly. *Female terminalia:* Ovipositor sheath 2.18 mm long, rather stout, about 0.88 mm from base. Rasper of rather stout hooks in a triangular patch of about 5 rows. Ovipositor 2.01 mm long, slightly widened at base, the tip 0.25 mm long, tapering from base of serrate portion to rather acute apex, with about 16 serrations on each side.

Type material.—Holotype, female (U.S.N.M. no. 56322).

Type locality.—Bartica, British Guiana.

The single specimen was collected by H. S. Parish, August 26, 1901.

This species would run to couplet 86, but it differs from *zuelaniae* Stone in having no constriction between the end of the oviduct and the beginning of the serrations, and in having the V-band of the wing narrowly joined to the S-band; it differs from *turpiniae* Stone in having the serrations of the ovipositor tip more extensive, the nonserrate portion of the tip less tapering, and the V-band of the wing narrowly joined to the S-band.

Anastrepha dryas, n. sp.
Figs. 3, 11

Medium sized. Mesonotum 3.0 mm long, orange-brown, with humerus, a median stripe expanding abruptly posteriorly to reach the dorsocentral bristles, a lateral stripe from just in front of transverse suture to scutellum, and scutellum pale yellow; pleura mostly pale yellow; metanotum entirely yellow-orange. Macrochaetae brownish black; pile yellowish brown. Sterno-pleural bristle very weak. Wing 7.5 mm long, the bands orange yellow and brown; costal and S-bands narrowly connected at vein R_{4+5} and hyaline triangle beyond stigma constricted or closed at vein R_{2+3}; V-band rather broad anteriorly, entirely separated from S-band; vein R_{2+3} slightly undulant at level of hyaline triangle. *Female terminalia:* Ovipositor sheath 3.86 mm long, tapering to apical third and then nearly parallel sided, the spiracles 1.1 mm from base. Rasper of many long, curved hooks in about 11 rows. Ovipositor 3.53 mm long, the extreme base slightly widened, the apical portion slightly widened to level of serrations; ovipositor tip about 0.4 mm long, the many minute serrations starting at basal fifth and the serrate portion tapering to an acute point.

Type material.—Holotype, female (U.S.N.M. no. 56323).

Type locality.—San Esteban, Carabobo, Venezuela.

The single specimen was collected by Pablo Anduze between December 1 and 6, 1939.

This species will run to *duckei* Costa Lima in couplet 90, but differs from *duckei* in being a

smaller species, with many more teeth in the rasper, and with a stouter ovipositor tip, not at all constricted basad of the serrate portion. The species is also close to *dissimilis* Stone, the terminalia being very similar, but the median portion of the S-band is considerably narrower in *dissimilis*, so that the costal and S-bands are widely separated.

New Records for Anastrepha Species

Distribution

As a result of the study of additional material including the new species described in this paper, the following new records of distribution have been discovered:

Argentina (10)[3]:

Anastrepha dissimilis Stone. Two females and two males reared at Corrientes, May 9, 1941, from *Passiflora*, by H. L. Parker.

British Guiana (11):

Anastrepha fraterculus (Wied.); *A. guianae*, n. sp.; *A. parishi*, n. sp.; *A. serpentina* (Wied.).

Panamá (59):

Anastrepha doryphoros, n. sp.; *A. gigantea*, n. sp.; *A. perdita* Stone, a female, trapped at El Cermeño, January 27, 1942, by James Zetek; *A. subramosa* Stone (inadvertently omitted from list in writer's revision); *A. teli*, n. sp.

United States (16); Texas (11):

Anastrepha lathana Stone, Webb County, Tex., December 4, 1940, G. H. Shiner.

Venezuela (15)

Anastrepha anduzei, n. sp.; *A. cordata* Aldrich; *A. dryas*, n. sp.; *A. grandis* (Macquart); *A. manihoti* Costa Lima.

Food Plants

Additional reared material, from various sources, has resulted in the following new[3] data on food plants:

[3] Numbers in parentheses here after each country indicate the total number of species now known.

Achras sapota L. (Sapotaceae). Experimental food plant of *Anastrepha flavipennis* Greene by James Zetek.

Eugenia coloradoensis Standley (Myrtaceae). *Anastrepha fraterculus* (Wied.) on Barro Colorado Island, reared by James Zetek.

Eugenia variabilis Baillon (Myrtaceae). According to Max Kisliuk, the guarobeiera, listed in the writer's paper as host of *bahiensis* and *bondari*, is this species.

Labatia standleyana (Pittier) (Sapotaceae). The first recorded natural food plant for *Anastrepha flavipennis* Greene, reared by James Zetek from El Cermeño, Panamá, June 17, 1941. *A. serpentina* (Wied.) was reared from this host at the same time.

Lucuma obovata HBK. (Sapotaceae). Dr. J. E. Wille, chief of the Peruvian Entomological Service, has informed the writer that this is the preferred host of *Anastrepha serpentina* (Wied.) in Peru, the infestation sometimes being very heavy.

Mangifera indica L. (Anacardiaceae). Experimental food plant of *Anastrepha flavipennis* Greene by James Zetek.

Passiflora sp. (Passifloraceae). *A. dissimilis* Stone reared at Corrientes, Argentina, by H. L. Parker.

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BACTERIOLOGY.—*Incidence of leptospirosis among dogs in Honolulu as determined by serological agglutination tests.*[1] JOSEPH E. ALICATA and VIRGINIA BREAKS, Honolulu, T. H.

Recent reports of the widespread occurrence of leptospirosis among dogs in the continental United States have caused considerable veterinary and public-health interest in this disease. Geographically, the cases reported involve 14 states: Alabama, California, Connecticut, Georgia, Louisiana, Massachusetts, Maryland, Michigan, New Jersey, New York, Ohio, Pennsylvania, Virginia, and Wisconsin. Cases have been reported also from the District of Columbia and Puerto Rico (1). Serological studies have shown 34.0 percent canine infection in some sections of California (4), 11.8 percent in New York (4), and 38.1 percent in Pennsylvania (5). These and other reports have led to the conclusion that probably 25 to 50 percent of the dogs in the United States are temporary or permanent carriers of the causative organisms *Leptospira canicola* and *L. icterohemorrhagiae* (2).

The present paper, reporting on positive leptospiral sero-reactions, presents additional information regarding the geographical distribution and incidence of canine leptospirosis. The presence of this disease in dogs became suspected following recognition of local human and murine leptospirosis in 1937 (3), and from communications received from local veterinarians regarding the existence of undiagnosed cases of acute jaundice. The first findings of *Leptospira* agglutinins in the sera of local dogs were made in 1940 on the sera of 7 out of 11 dogs submitted for examination by Dr. L. C. Moss, veterinarian, to Dr. K. F. Meyer, Hooper Foundation, San Francisco, Calif.

Methods.—Sera were collected from 23 dogs (nos. 1–23) submitted to a veterinary hospital for various causes and 77 (nos. 24–100) obtained at random from a local dog pound. In each case the blood was withdrawn from the femoral vein. Only one test was conducted on each animal. The microscopic agglutination test, using fresh formalin-killed antigens, was used. The porcelain-plate method as described by Meyer, Stewart-Anderson, and Eddie (4) was adopted. Each of the sera was tested for agglutinins against the canicola strain, *L. canicola*, and the classical strain, *L. icterohemorrhagiae*. A series of dilutions of serum was made with Verwoort-Schüffner buffer solution. The final dilutions in the plates ranged from 1:10 to 1:30,000. The clumps of agglutinated organisms were ascertained by the use of a darkfield. Since agglutination in low dilutions is considered doubtful, only serum positive in a dilution of 1:100, or greater, is regarded in this study as significant.

Results and interpretation of the serological agglutination tests.—As shown in Table 1 and summarized in Table 2, of the 100 dogs examined 20 gave stronger sero-agglutination reactions to *L. icterohemorrhagiae* than to *L. canicola*, as follows: 1 in 1:100, 15 in 1:300, 2 in 1:1000, 1 in 1:10,000, and 1 in 1:30,000. In addition, 19 sera reacted more strongly to *L. canicola*, as follows: 1 in 1:100, 7 in 1:300, 5 in :1,000, 1 in 1:10,000, and 5 in 1:30,000. Those cases in which the titer was between 1:100 to 1:1000 and the animals appeared normal were considered as possible latent infections; those that showed illness, as in nos. 1, 2, 9, 13, and 21, might have represented an early stage of the disease and not sufficient time had elapsed for agglutinins to develop in larger amounts. The 8 cases reported (nos. 17, 3, 27, 12, 35, 62, 78, and 88) in which the agglutination titer was between 1:10,000 and 1:30,000 are regarded as active clinical cases. Of these, the 2 dogs (nos. 17 and 3)

[1] Study conducted from special funds appropriated by the Public Health Committee of the Chamber of Commerce of Honolulu and through the facilities of the University of Hawaii. The writers wish to express their appreciation to Dr. K. F. Meyer and Mrs. B. Stewart-Anderson of the Hooper Foundation, University of California, for helpful suggestions in the course of this study and for submitting our original strains of *Leptospira* cultures; also to thank Dr. L. C. Moss for making possible the obtaining of the sera used in this survey. Received April 9, 1942.

reacting positive to the classical strain showed jaundice whereas the other 6 dogs reacting positive to the canicola strain were anicteric and showed, in most cases, general malaise, muscular tremor, and dehydration.

Through the use of culture methods (Verwoort's medium), leptospirae were isolated from the kidneys of two dogs suspected of having died of canicola fever. One of these dogs, just before death, showed a sero-agglutination titer of 1:300,000 for *L. canicola* and 1:30,000 for *L. icterohemorrhagiae*. The other dog, just before death, showed a sero-agglutination titer of 1:10,000 for *L. canicola* and 1:1,000 for *L. icterohemorrhagiae*.

Discussion.—The results of this study indicate that 39 percent of the dogs examined had or were passing through a case of leptospirosis. Of these, about one-half showed infection with the classical strain and the other half with the canicola strain. These findings differ from reports of surveys conducted in the continental United States where the canicola strain has usually been found most common. In San Francisco, of 59 dogs examined 3 reacted to the classical strain and 33 to the canicola strain (4); in New York, of 111 dogs examined 3 reacted to the classical strain and 10 to the canine strain (4); in Pennsylvania, of 105 dogs examined canicola strain was found to be three times as frequent as the classical strain (5). On the other hand, Meyer and coworkers (4) found 10 out of 12 dog sera from Detroit, Mich., positive for the classical strain; the dogs, in this case, were reported to be in some way connected with cases of human Weil's disease.

The epizootiological relationships of canine and murine leptospirosis has not been definitely established. In San Francisco, Meyer and coworkers (4) found a low incidence of infection with *L. icterohemorrhagiae* among dogs in spite of the fact that 35 percent of the rats in the same locality were found to carry this organism. Of a series of 500 rats trapped at random in Honolulu, silver-stained sections of kidneys of these animals revealed only 13 or 2.6 percent infection with leptospirae. All these positive rats were trapped in localities near fresh-water streams. Kidney emulsion of these rats produced clinical leptospirosis with jaundice when inoculated into young mice and guinea pigs. These findings point out a low relationship between the incidence of murine and canine leptospirosis. Infection of dogs with the classical strain appears therefore to be brought about by intercanine association in the same way that the canicola infection takes place among dogs. The canicola strain as far as is known is not found in rats.

Summary.—Microscopic agglutination tests, using fresh formalin-killed *Leptospira canicola* and *L. icterohemorrhagiae* as antigens, have been conducted on the sera of 100 dogs from Honolulu. Of these, 20 percent of the sera gave stronger agglutination reactions to *L. icterohemorrhagiae* than to *L. canicola* and 19 percent reacted more strongly to *L. canicola*.

Leptospirae were recovered from two dogs suspected of having died of canicola fever.

Out of 500 rats examined in Honolulu, 2.6 percent were found to harbor leptospirae. This low incidence points out little epizootiological relationship between murine and canine infections. The disease in dogs with the classical strain of *Leptospira* is believed to be brought about through intercanine associations as in the case of the canicola strain.

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TABLE 1.—POSITIVE LEPTOSPIRA AGGLUTINATION REACTIONS NOTED IN THE SERA OF 39 OUT OF 100 DOGS EXAMINED; FORMALINIZED CULTURES OF L. ICTEROHEMORRHAGIAE AND L. CANICOLA USED

Dog No.	Titer of sero-reaction: First line for *L. icterohemorrhagiae;* second line for *L. canicola*								Clinical observations
	1:10	1:30	1:100	1:300	1:1,000	1:3,000	1:10,000	1:30,000	
42	+++ +++	++ +	++ 0	0 0	0 0	0 0	0 0	0 0	Normal
1	++ 0	++ 0	++ 0	+ 0	0 0	0 0	0 0	0 0	Icteric
2	+++ 0	+++ 0	+++ 0	++ 0	0 0	0 0	0 0	0 0	General malaise
9	+++ +++	+++ +	++ 0	+ 0	0 0	0 0	0 0	0 0	Bloody urine
10	++ 0	++ 0	++ 0	+ 0	0 0	0 0	0 0	0 0	Dermatitis
13	+++ +++	+++ ++	++ +	+ 0	0 0	0 0	0 0	0 0	Coughing, subnormal temperature
19	++++ +	+++ +	++ 0	+ 0	0 0	0 0	0 0	0 0	Normal
51	+++ ++	+++ ++	++ +	+ 0	0 0	0 0	0 0	0 0	Normal
53	+++ +	+++ 0	++ 0	+ 0	0 0	0 0	0 0	0 0	Normal
59	+++ ++	+++ ++	++ +	+ 0	0 0	0 0	0 0	0 0	Normal
60	+++ +++	+++ ++	++ +	+ 0	0 0	0 0	0 0	0 0	Normal
61	+++ +++	+++ ++	++ +	+ 0	0 0	0 0	0 0	0 0	Normal
69	+++ ++	+++ ++	+ +	+ +	0 0	0 0	0 0	0 0	Normal
74	++++ +++	+++ ++	+++ +	++ +	0 0	0 0	0 0	0 0	Normal
84	++++ ++	+++ ++	++ +	+ 0	0 0	0 0	0 0	0 0	Normal
95	+++ ++	+++ +	++ 0	+ 0	0 0	0 0	0 0	0 0	Normal
68	++++ ++	+++ ++	++ +	+ +	+ 0	0 0	0 0	0 0	Normal
80	++++ ++	+++ ++	+++ +	++ 0	+ 0	0 0	0 0	0 0	Normal
17	++++ +++	++++ ++	+++ ++	+++ ++	++ +	+ +	+ 0	0 0	Icteric; vomiting
3	++++ ++++	++++ ++++	++++ ++++	++++ +++	+++ ++	+++ 0	+++ 0	++ 0	Icteric
64	++ +++	+ +++	0 +	0 0	0 0	0 0	0 0	0 0	Normal
16	+++ +++	++ +++	+ ++	0 +	0 0	0 0	0 0	0 0	Stomatitis

TABLE 1—*Continued*

Dog No.	Titer of sero-reaction: First line for *L. icterohemorrhagiae;* second line for *L. canicola*								Clinical observations
	1:10	1:30	1:100	1:300	1:1,000	1:3,000	1:10,000	1:30,000	
18	++ ++	+ ++	0 ++	0 +	0 0	0 0	0 0	0 0	Normal
29	++ +++	++ ++	+ ++	0 +	0 0	0 0	0 0	0 0	Normal
55	++++ ++++	+++ ++++	++ +++	0 +	0 0	0 0	0 0	0 0	Normal
67	++ +++	+ +++	+ ++	0 +	0 0	0 0	0 0	0 0	Normal
83	+++ +++	++ +++	+ ++	0 +	0 0	0 0	0 0	0 0	Normal
93	++ ++++	+ +++	+ ++	0 +	0 0	0 0	0 0	0 0	Normal
21	++ +++	+ +++	+ ++	+ ++	0 +	0 0	0 0	0 0	Vomiting
37	+++ +++	++ +++	+ ++	0 ++	0 +	0 0	0 0	0 0	Normal
43	+++ ++++	++ +++	++ ++	+ ++	0 +	0 0	0 0	0 0	Normal
46	+ +++	+ +++	0 ++	0 ++	0 +	0 0	0 0	0 0	Normal
57	++++ ++++	+++ +++	++ +++	+ +	+ +	0 +	0 0	0 0	Normal
27	++ ++++	++ ++++	+ +++	+ +++	0 ++	0 +	0 +	0 0	Malaise; dehydration; muscular tremor
12	++++ ++++	++++ ++++	++++ ++++	+++ ++++	+++ ++++	+ ++++	0 +++	0 +	Vomiting; dehydration
35	++ ++++	+ ++++	0 ++++	0 ++++	0 +++	0 +++	0 +++	0 ++	Malaise; dehydration
62	++++ ++++	++++ ++++	++++ ++++	++++ ++++	+++ ++++	+++ ++++	+++ ++++	++ +++	Dehydration; muscular tremor
78	++++ ++++	++++ ++++	+++ ++++	+++ ++++	+ +++	0 ++	0 ++	0 +	Malaise; dehydration
88	++++ ++++	++++ ++++	+++ ++++	+++ ++++	++ ++++	++ ++++	++ +++	+ ++	Malaise; muscular tremor

TABLE 2.—SUMMARY OF THE AGGLUTINATION TITER OF THE 39 POSITIVE DOG SERA

Number reacting more strongly to:	Titer						Total
	1:100	1:300	1:1,000	1:3,000	1:10,000	1:30,000	
L. icterohemorrhagiae.....	1	15	2	0	1	1	20
L. canicola.....	1	7	5	0	1	5	19

ZOOLOGY.—Stereobalanus canadensis (*Spengel*), *a little-known enteropneustan from the coast of Maine.*[1]

EDWARD G. REINHARD, Catholic University of America and University of Maine Marine Laboratory.

A considerable number of specimens of an enteropneustan, hitherto known only from four fragments dredged off Cape Breton, Nova Scotia, were collected by the author on the coast of Maine during the summers of 1940 and 1941. William C. McIntosh, who collected the type material, sent it to Spengel in 1878 for study. The latter described the animal (1893) under the name *Balanoglossus canadensis* and subsequently (1901) created a new genus, *Stereobalanus*, to receive it. Although Spengel's description is extremely detailed and authoritative, it is necessarily lacking in some particulars since the material was poorly preserved and did not comprise a complete specimen. These deficiencies, coupled with the fact that the appearance of the animal when alive was entirely unknown also introduced unavoidable errors into the description. Spengel himself, commenting on the poor quality of the specimens, remarks: "Dies ist um so mehr zu bedauern, als *Balanoglossus canadensis* durch eine ganze Reihe interessanter Eigenthümlichkeiten ausgezeichnet ist. Eine abermalige Untersuchung dieser Art unter Benutzung reicheren und besser erhaltnen Materials ist daher sehr wünschenswerth."

Stereobalanus was first encountered by the author on July 31, 1940, while on a dredging trip in Frenchmans Bay with a party of students and staff members of the University of Maine Marine Laboratory. The collecting ground has been revisited on two occasions since, and no dredge haul has failed to yield some specimens of this species. The hauls were made at a depth of 40–50 feet about half a mile southeast of Crabtree Light at the mouth of Sullivans River. The bottom at this station is a soft, fine mud. Together with *Stereobalanus canadensis*, the dredge usually contained such mud-dwellers as the hydroid *Corymorpha pendula*, the polychaete *Nephthys caeca*, or the starfish *Ctenodiscus crispatus*.

It is very difficult to collect this animal in perfect condition with the apparatus used, a 3-foot scallop drag. A box dredge or some other type of equipment might give better results. *Stereobalanus* is extremely soft-bodied and fragile. The specimens were mostly entangled in the meshes of the net bag and almost invariably mutilated. Although more than 40 were obtained, only 4 were entire. I was fortunate in being able to enlist the aid of my friend Dorothy Olsen Johnston, collaborating artist of the American Museum of Natural History, who at once made color sketches of the living animal. For her work, reproduced in Fig. 1, I am deeply grateful.

Size.—Total length up to 50 mm. Since Maine is probably the southern limit of the species, it is likely that Nova Scotia specimens may be larger.

Color.—The color is a pale lemon-yellow except for the liver region, which is brown.

Proboscis.—The proboscis of the largest specimen, measured alive, showed a length of 11 mm and a width of 6 mm. Well-fixed mature specimens had proboscides averaging 6–7 mm in length and about 5 mm in width at the base. The dimensions given by Spengel for the proboscis (5 mm long and 7 mm wide) and his illustration (pl. 17, fig. 1) are obviously based on strongly contracted specimens. In life, the proboscis is nearly twice as long as it is broad, and even in properly fixed animals it retains a length greater than the width.

As in other Enteropneusta, the proboscis is joined to the anterior surface of the collar by means of a short, thin, tapering neck. Spengel's statement that the neck is absent in *Stereobalanus* is clearly erroneous and again attributable to the highly contracted nature of the material at his disposal.

Collar.—The collar is approximately as wide as the base of the proboscis and has a length of 2–3 mm. It is very short in comparison to the collar-length of most other Enteropneusta. The presence of two circular furrows gives the collar a triannulate appearance. Spengel was unable to discover collar-pores in this species, but they are

[1] Received June 9, 1942.

clearly evident if the collar is severed from the trunk and the posterior collar surface examined. The pores lie directly dorsal to the pharynx, one on each side of the midline.

Skeleton of proboscis and collar.—This is sufficiently well illustrated in Fig. 2 to require no additional comment. The drawing was made from a whole mount of a small specimen and checked against maceration-preparations of larger specimens.

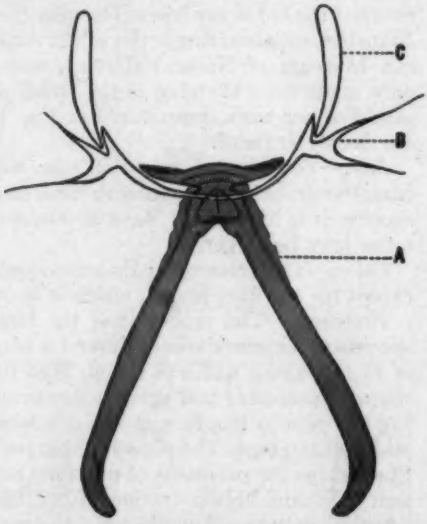

Fig. 2.—The proboscis skeleton of *Stereobalanus canadensis*, ventral aspect, with associated structures: A, proboscis skeleton; B, chondroid tissue; C, marginal lamellae.

Trunk.—The trunk measures up to 36 mm in length and is nearly uniform in diameter except in the caudal region where it becomes somewhat less thick. Its general width equals or slightly exceeds that of the proboscis and collar. It bears a distinct dorsal and ventral longitudinal ridge, and its surface, except for these ridges, is conspicuously ruffled.

In the branchiogenital region, which is immediately posterior to the collar, *Stereobalanus* exhibits several unusual features. Instead of possessing a series of gill pores, as does the familiar *Dolichoglossus*, there is a single, deep, slitlike pore on each side, dorsolateral in position. Its presence gives rise to a smaller dorsal and larger ventral genital wing in which the gonads are located. The gills are visible externally, particularly if the genital wings are spread apart slightly.

The number of gills varies with the size of the individual. Young specimens have 12 or 13 pairs of gills, while average mature individuals have about 36 pairs. The gill skeleton consists of 3-pronged forks. The arch that joins the three prongs of a fork

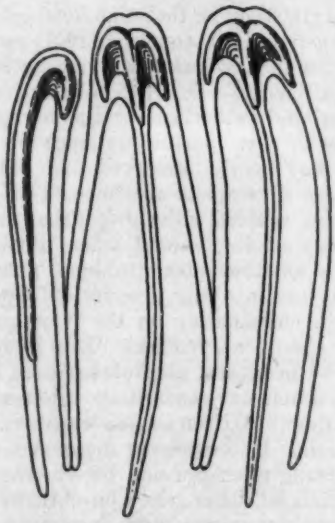

Fig. 3.—The first three forks of the gill skeleton of a mature *Stereobalanus canadensis* showing chitinous thickenings as seen from inner side.

together is feeble in young specimens and in the posterior gills of older animals. Elsewhere it is greatly thickened with a massive cap of chitin. Spengel's "Rücken massig verdickt." is therefore true only of the older gill skeletons.

Following the branchiogenital region, a portion of the trunk entirely devoid of gills or gonads intervenes before the liver region is reached. This transitional portion, which is somewhat longer than the branchiogenital region itself, was somehow missed by Spengel, who reported the liver region as following directly upon the gill region. Van der Horst (1927–39), on the basis of comparative studies on other Enteropneusta,

Fig. 1.—*Stereobalanus canadensis* (Spengel). Four times natural size. From a color sketch of the living animal by Dorothy Olsen Johnston.

challenged this point in Spengel's description of *Stereobalanus canadensis*. Reexamination of this species therefore fully confirms Van der Horst's suspicion (*l.c.*, p. 240).

The hepatic region, distinctly set apart by its dark color in life, occupies about one-fifth of the trunk length, but its anterior and posterior limits are not sharply defined. The skin in this region is thrown into transverse rugae which appear to be finer and more pronounced than those present elsewhere on the trunk.

The posthepatic region possesses no special external features. In some specimens the anus is terminal, in others it appears to be ventral and subterminal.

General remarks.—This species is the only known representative of the genus *Stereobalanus*. It is hoped that rediscovery of this animal in a locality where further specimens are easily obtainable will stimulate research into the internal anatomy and histology of a species that manifests morphological peculiarities of great interest, among them being a proboscis sense organ unique among Enteropneusta. The specimens obtained in Maine, after anesthetization, were fixed in Kleinenberg's solution and stored in alcohol. They have been deposited in the U. S. National Museum.

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PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

PHILOSOPHICAL SOCIETY

1187TH MEETING

The 1187th meeting was held in the Cosmos Club auditorium, Saturday, October 11, 1941, President MCCOMB presiding. The program consisted of a series of papers on the National Geographic Society—National Bureau of Standards Eclipse Expedition of 1940.

IRVINE, C. GARDNER (National Bureau of Standards): *The design and construction of eclipse apparatus.*

PAUL A. MCNALLY, S. J. (Georgetown University): *Contact times of the 1940 eclipse, determined from photographs of the partial phases.*

E. O. HULBURT (Naval Research Laboratory): *Sky brightness at Patos, Brazil, during twilight and during the total solar eclipse of 1940.*

C. C. KIESS (National Bureau of Standards), by invitation[1]: *The 1940 flash spectrum.*

T. R. GILLILAND (National Bureau of Standards), by invitation: *Radio observations of the ionosphere at the 1940 eclipse in Brazil.*

R. H. STEWART (National Geographic Society), by invitation: *The story of the expedition in colored motion pictures.*

The National Geographic Society–National Bureau of Standards Eclipse Expedition of 1940 was stationed at Patos, in the state of Paraiba de Norte of Brazil, this location being north and west of Recife. The eclipse was on October 1. The program of scientific work planned for this expedition was so varied in nature that results of considerable scientific importance were obtained although a thin veil of clouds partially obscured the eclipse during the period of totality. Mr. Irvine C. Gardner, the leader of the expedition, described the new corona cameras, polarigraphs, and spectrographs which were specially designed and constructed for use at this expedition.

[1] The words "by invitation" signify that the author was not a member of the Society.

1188TH MEETING

The 1188th was a joint meeting with the Washington Academy of Sciences on October 16, 1941. Commdr. FRANCIS W. REICHELDERFER, Chief of the Weather Bureau, delivered an address entitled *Some famous weather maps.*

1189TH MEETING

The 1189th meeting was held in the Cosmos Club auditorium, Saturday, October 25, 1941, President MCCOMB presiding. An invited paper on *X-ray spectroscopic studies of multiple ionization* was presented with illustrations by Mr. L. G. PARRATT, of Cornell University. The paper

was discussed by Messrs. F. L. MOHLER and A. BLAKE.

1190TH MEETING

The 1190th meeting was held in the Cosmos Club auditorium, Saturday, November 8, 1941, President MCCOMB presiding. An invited paper on *The modern nautical chart—a scientific achievement* was presented with illustrations by Mr. AARON L. SHALOWITZ, of the Coast and Geodetic Survey. Ptolemy, the Portolanos, and Mercator were the three great early influences on contemporary chart making. The beginning of the modern nautical chart dates back to less than 150 years ago when systematic surveying was instituted by the various maritime nations. In this country the Coast and Geodetic Survey published its first chart of New York Harbor in 1845, and marked a definite departure from the uncoordinated and highly generalized surveys of Colonial days. Progressive development in methods of surveying, particularly in the application of sound to the determination of depth and distance, has steadily pushed forward the frontiers of accurate hydrographic surveys and has given the nautical chart a leadership in precision seldom attempted in other branches of map construction. In the most recent type of chart greater emphasis is laid on depth contours in order to bring into prominence the many submarine features that are useful to the modern navigator equipped with an echo-sounding device.

An invited paper on *Reproduction of charts and maps* was presented with illustrations by Mr. DUDLEY P. BARNETTE, of the Coast and Geodetic Survey.

Reproduction of charts and maps for issue to the public is accomplished by several methods. For quick reproduction or for temporary use, photostats, ozalid prints, blueprints, or bromide enlargements may be used.

For quantity production, photoengraving (line-cuts), wax engraving, or photolithography are the methods to be used. Photoengraving and wax engraving offer little opportunity for corrections or changes to the printing plate, but in the more widely used method of photolithography the metal printing plate may be easily corrected or changed. Photolithography and offset printing are now synonymous, since the older method of photolithography from stone printing plates is rapidly disappearing. In photolithography, color work, either simple, such as solid color areas, or complicated, such as patterns, stipples, rulings or screens, can be readily accomplished.

Photolithography requires the skill of many artisans to accomplish the final product. Represented in this list are artists, draftsmen, copper-plate engravers, photographers, type compositors, transferers, process plate makers, and pressmen, each rendering a separate contribution to the whole.

In lithography such methods as deep etch, dry-lithography, and Van Dyke are used under circumstances fitting to the subject and quantity of production.

Many time-saving methods are used in connection with the reproduction of charts such as mechanically engraving lettering, soundings (figures), and symbols in copper plate engraving or engraving on stained glass negatives, and the use of mechanically made shading mediums to emphasize particular features.

1191ST MEETING

The 1191st meeting was held in the Cosmos Club auditorium, Saturday, November 22, 1941, President MCCOMB presiding. An invited paper on *Microphotography* was presented with illustrations by Mr. VERNON D. TATE, of the National Archives. It was discussed by Dr. BROMBACHER.

A microphotograph is a reduced-size photographic facsimile of a textual original that is too small to be read by the unaided eye. In recent years, microphotography has become a medium of immense significance in the collection, preservation, use and dissemination of documentary materials of all types. The technique is employed in archives, libraries, museums, and other scholarly institutions, in business and industry, by societies and committees, individuals, and the Federal Government. Although popularly considered new, microphotography can be traced back almost a hundred years. Equipment is available for small, medium-sized, and large-scale undertakings. The product, by act of Congress, must be judicially noticed. Microphotography is regarded by those who have interested themselves in its application to documentation as the most significant technological achievement since the invention of printing.

A paper on *Quartz resonators* was presented with illustrations by Mr. FRANCIS E. FOX, of the Catholic University of America. It was discussed by Mr. A. BLAKE.

Quartz plates have become very widely used for frequency stabilization of oscillators, in "single frequency" and other electrical filters, and as sources of high frequency sound. There has been a large amount of investigation concerning the resonant and oscillating frequencies of such quartz plates, and the problem of determining the resonant frequencies of such a slab is far from simple for such a complex structure as that of quartz.

For special configurations (long thin rods, thin circular plates, wave surface plates, etc.) approximations may be obtained that yield several discrete sets of frequencies, and the interaction of these frequency sets produces "combination frequency sets." The vibration of specimens may be investigated optically by using the specimen as one arm of an interferometer; by an analysis of the electrical resonance curves, and so on. In one specimen, an x-cut quartz plate $2.50 \times 2.50 \times 0.11$ cm, over 200 distinct resonant frequencies were observed in the frequency range from 2,436 kc to 2,552 kc.

1192D MEETING

The 1192d meeting was held in the Cosmos Club auditorium, Saturday, December 6, 1941, President MCCOMB presiding. Mr. GIBSON read the report of the treasurer, Mr. DEMING, the latter being delayed by storms, which held up air service from Providence, where he had been lecturing. The treasurer's report stated that the income from dues and investments was $1,308.81, that the expenditures were $1,280.55, leaving a surplus of $28.26. The average expenditure per member was $4.09. During the year a $2,000 Cosmos Club bond was called, and the $2,000 is held in a trust account, which was discussed by Messrs. M. D. HERSEY, W. G. BROMBACHER, F. G. BRICKWEDDE, H. H. HOWE, and W. J. HUMPHREYS. The report of the auditing committee, H. S. RAPPLEYE, L. V. JUDSON, and G. R. WAIT, was presented by the chairman, Mr. RAPPLEYE. The report of the auditing committee was accepted as read, and the report of the treasurer was accepted.

The joint report of the secretaries was presented by the corresponding secretary, Mr. STIMSON. It showed an active membership of 315 as of December 1, 1941. The following persons were elected to membership during the fiscal year: CARL A. BECK, L. T. BOURLAND, F. W. BROWN, 3d, PATRICK J. DONOVAN, W. J. ECKERT, ALEXANDER ELLETT, GAETANO FERLAZZO, FRANCIS D. FOX, HERBERT FRIEDMAN, KARL GERHARD, ROBERT WINSLOW GORDON, ARMIN W. HELZ, JOHN M. IDE, WM. G. MADOW, Mrs. MARCELLA L. PHILLIPS, MORRIS RELSON, GEORGE D. ROCK, WM. H. SANDERS, HAROLD L. SAXTON, PAUL LAURENS SMITH, RICHARD TOUSEY, HORACE M. TRENT, CLEMENT WINSTON, WM. E. WOOD.

The report of the committee on elections, F. WENNER, H. D. HARRALON, and MICHAEL GOLDBERG, was presented by the chairman, Mr. WENNER. He announced that all the elected officers received a majority of the votes with respect to each of the remaining candidates for the same office. Messrs. H. H. HOWE, H. L. CURTIS, A. G. MCNISH, and F. WENNER discussed the precedent that the actual count of the votes should not be announced. The report was accepted and the president declared the following to be duly elected:

President: W. G. BROMBACHER.
Vice Presidents: R. J. SEEGER, H. F. STIMSON.
Corresponding Secretary: W. EDWARDS Deming.
Treasurer: WALTER RAMBERG.
Members-at-large of the General Committee: G. GAMOW, C. L. GARNER.

The president opened the meeting for discussion of Society policies and recommendations to the General Committee. Mr. SEEGER as an editor of the JOURNAL of the Washington Academy of Sciences commended Mr. L. V. JUDSON for his efficient work as associate editor for the Philosophical Society. The publications of the Society and of the JOURNAL were also discussed by Messrs. M. D. HERSEY, L. B. TUCKERMAN, and W. J. HUMPHREYS.

The acting secretary, Mr. STIMSON, read a rough draft of the minutes, and these were approved as read.

A paper on *Great geomagnetic storms of the present sun-spot cycle* was presented with illustrations by Mr. A. G. MCNISH of the Department of Terrestrial Magnetism. It was

discussed by Messrs. H. L. CURTIS, P. A. SMITH, F. WENNER, and N. H. HECK.

The President announced the program for the next meeting. He then asked Past Presidents, R. E. GIBSON and F. G. BRICKWEDDE, to escort the newly elected President, Mr. BROMBACHER, to the chair. After a few remarks Mr. BROMBACHER adjourned the meeting for the social hour.

1193D MEETING

The 1193d meeting was held in the Cosmos Club auditorium, Saturday, December 20, 1941, President BROMBACHER presiding. An invited paper on *Archery paradise, paradox, and paralysis* was presented with slides and motion pictures by Mr. C. N. HICKMAN, of the Bell Telephone Laboratories. It was discussed by Messrs. OLMSTEAD, PAWLING, DEMING, BRIGGS, GAMOW, P. A. SMITH, L. B. TUCKERMAN, and F. B. SILSBEE.

Up until about 12 years ago, the velocity of an arrow had never been measured except by the use of a stop watch. During the past 10 years the study of the internal ballistics of the bow and arrow has furnished a paradise for a number of physicists. For at least two centuries archers have tried to explain the paradox of how an arrow gets around the bow to hit the mark that it is pointed at. Moving pictures, taken at the rate of 4,000 frames a second, show how the arrow gets around the bow. Over 50 percent of the archers, sooner or later, are stricken with what is often called paralysis or freezing. This interesting but annoying affliction was discussed.

The President announced the appointments to the Committee on Membership for the current year: WILLIAM A. WILDHACK (National Bureau of Standards), chairman, ALBERT K. LUDY (Coast and Geodetic Survey), and HOWARD S. ROBERTS (Geophysical Laboratory).

1194TH MEETING

The 1194th meeting was held at the Cosmos Club auditorium, Saturday, January 17, 1942, President BROMBACHER presiding. The program consisted of an address by the retiring president, Mr. MCCOMB, on the subject *Geophysical measurements in the laboratory and in the field*. This address appeared in this JOURNAL **32**: 65-79 1942.

1195TH MEETING

The 1195th meeting was held in the Cosmos Club auditorium, Saturday, January 31, 1942, President BROMBACHER presiding. A paper on *The ABC's of physical measurements* was presented with illustrations and demonstrations by Mr. FRANK WENNER, of the National Bureau of Standards. It was discussed by Messrs. BLAKE and CRITTENDEN. The formulation of a more or less complete system of physical quantities, dimensions, standards, units, and quantitative expressions involves an analysis of the results obtained in a variety of physical measurements. All such systems, whether considered to be merely systems of units or systems of measurements, must of necessity be based on some philosophical point of view. While any one of several philosophical points of view may be used, the major features of that used in discussing the ABC's of physical measurements are these:

1. Words such as length, time, area, volume, velocity, resistance, field strength, induction, etc., serve to suggest mental concepts of quantities which are of different physical natures. No one of these physical natures is definable in terms of the others.

2. The proportionality factor that appears in the relation between the result obtained when a quantity is measured by the use of a standard of a like quantity, and the result obtained when the quantity is measured by the use of a standard of an unlike quantity, is a physical quantity. For example, a current may be measured by the use of a standard of current. It may also be measured by the use of a standard of electromotive force. The first gives

$$I = A \text{ units of current}$$

and the second gives

$$I = BC \text{ units of electromotive force}$$

where I represents the current, A and C numbers, and B the proportionality factor. Measurements similar to these constitute the experimental basis of one of the group of relations which taken collectively is known as Ohm's law. Here B represents the conductance or reciprocal of the resistance. In many analogous cases the proportionality factor always has the same magnitude. In these cases it is considered to be a constant of nature, but

nevertheless it is a physical quantity, not merely a number.

The paper was illustrated by lantern slides and by the making of a number of measurements. Measurements of the earth's magnetic field and of the earth's magnetic induction served to show that these quantities are of different physical natures, and that therefore the proportionality factor, namely, the permeability, is a physical quantity, not merely a number. These conclusions are of course based on the particular philosophical point of view used.

An invited paper on *The biological action of high energy radiation* was presented with slides and moving pictures by Mr. PAUL S. HENSHAW, of the National Cancer Institute. It was discussed by Messrs. BOWERS, WHITE, HUMPHREYS, ROLLER, and MOHLER.

Radiation such as X-rays or gamma rays of radium may, on the one hand, act on cells in such manner as to cause cancer, and on the other hand, in such manner as to cure it. Some insight into this seemingly paradoxic action was furnished by describing how radiation acts on certain simpler forms and by considering three basic types of radio-biologic action. In the killing of yeast cells, the breaking of chromosomes and the production of mutations, may vary directly with exposure to radiation. Where the effect is all-or-none, the change appears to be due to some kind of single event occurring in the cells. Second, in cases where the effect (such as multipolar cell division) is all-or-none but not manifest until a certain accumulation of dosage has taken place, the effect is due to the combined action of a series of events. Third, in cases where the effect is not all-or-none but manifested by degree (such as delay in cell division), the effect is likewise due to the combined action of a series of events, but in this case each event contributes to the amount of effect. These constitute the three basic types of radiobiologic action visualized at this time.

Whereas multipolar cell division, such as that caused by X-rays, usually leads to cell death, it may in some instances give rise to a cellular modification that permits malignant behavior. This furnished at least a plausible explanation of how radiation may, by the same mechanism of action, cause cell death in one instance and malignant growth in another.

The president announced that Mr. JOYCE had resigned as chairman of the Communications Committee because of duties requiring frequent absence from the city, and that Mr. JOHN BEEK, JR., had been elected to fill his place for the remainder of the term of office.

1196TH MEETING

The 1196th meeting was held in the Cosmos Club auditorium, Saturday, February 14, 1942, President BROMBACHER presiding. An invited paper on *The molecular basis for the mechanical properties of acetate rayon* was presented with illustrations by Mr. ARNOLD M. SOOKNE, of the Textile Foundation. It was discussed by Messrs. O'BRYAN, HARRIS, P. A. SMITH, ROLLER, and STIMSON.

The mechanical properties of films and filaments of cellulosic materials are known to be affected by the chain-lengths of the molecules that they are composed of, but the exact nature of the relationship is still unclear. As part of a general program of study of the physical properties of textile fibers, an investigation of the effect of chain-length on the mechanical properties of cellulose acetate is in progress by research associates of the Textile Foundation at the National Bureau of Standards.

The separation of cellulose acetate into fractions of widely different chain-lengths by fractional precipitation, and some of the mechanical properties of these fractions were described. The results of creep measurements made on films prepared from the fractions were analyzed in terms of the stretching of simple mechanical models composed of elastic elements (springs) and viscous elements (dashpots).

Some of the commercial implications of fundamental studies of fiber structure were discussed, with particular reference to the production from abundant materials of fibers having the desirable properties of those natural fibers of which there is a national shortage.

The president invited the members to present more informal communications.

1197TH MEETING

The 1197th meeting was held in the Cosmos Club auditorium, Saturday, February 28, 1942, President BROMBACHER presiding. An invited paper on *The electron microscope as a tool for the study of inorganic materials* was presented

with moving pictures and lantern slides by Mr. HERBERT INSLEY, of the National Bureau of Standards. It was discussed by Messrs. RAMBERG, H. L. CURTIS, SILSBEE, HUMPHREYS, DORSEY, P. A. SMITH, BROMBACHER, SAYLOR, BRUNAUER, BEEK, and MCBURNEY.

The electron microscope is useful for the study of inorganic materials occurring in very finely divided condition because of its high magnification, high resolving power, and great depth of focus. These characteristics are compared with those of the light microscope and some limitations of the electron miscroscope are pointed out. The operation of the microscope and preparation of object material are described with the aid of motion pictures.

In the study of clay minerals, the electron microscope has shown that (1) kaolinite and halloysite, which are very similar in X-ray structure patterns, occur in grains having dissimilar shapes, (2) clays that have similar colloidal properties may have very different particle shapes, (3) clays with somewhat different chemical compositions are similar in particle shape and size and may belong to the same isomorphous series.

1198TH MEETING

The 1198th meeting was held in the Cosmos Club auditorium, Saturday, March 14, 1942, President BROMBACHER presiding. A paper on *A new determination of the constant of gravitation* was presented with illustrations by Mr. Paul R. Heyl, of the National Bureau of Standards. It was discussed by Messrs. MASON, P. A. SMITH, WHITE, STIMSON, H. L. CURTIS, CRITTENDEN, and L. B. TUCKERMAN.

A new determination of the constant of gravitation has been made, using the torsion balance. The plan of work was the same as that published in the Bureau of Standards Journal of Research in December, 1930. A number of suggested improvements in the apparatus were considered, some of which were tried and two of which were adopted. Photographic recording of the time of swing was used in place of visual observation and a change was made in the position of the large attracting masses which greatly simplified the length measurements. Two different tungsten filaments were used, one hard drawn and one specially annealed and kept straight during the drawing and subsequent handling. The final result obtained was $6.673 \pm 0.003 \times 10^{-8}$ cm^3 g^{-1} sec^{-2}.

Compared with the 1930 result of $6.670 \pm 0.005 \times 10^{-8}$, it will be seen that the increase in precision is hardly appreciable. It may therefore be concluded that the limiting point of diminishing returns has been reached with this form of apparatus, and that future work on this constant must make use of a radically different method.

An informal communication on the trend of published values of the velocity of light with time was presented by Mr. H. L. CURTIS, of the National Bureau of Standards.

1199TH MEETING

The 1199th meeting was held in the Cosmos Club auditorium, Saturday, March 28, 1942, President BROMBACHER presiding. A paper on *The adsorption of gases and vapors on solids* was presented with illustrations by Mr. STEPHEN BRUNAUER, of the Bureau of Plant Industry. It was discussed by Messrs. HERZFELD, MOHLER, TUCKERMAN, HUMPHREYS, GOLDBERG, and DEMING.

Under the term "adsorption" chemists usually include two distinct phenomena: Van der Waals adsorption, a process resembling condensation; and chemical adsorption, a process similar to chemical reactions. Although there are some points of similarity, the two processes are different and require entirely different theoretical approach for their explanation. The classical treatment of Langmuir was meant to apply to both processes, and indeed there are a few isolated cases of adsorption where the theory does apply. The majority of experimental data, however, do not obey the Langmuir equation. The reason for this is different in the two adsorption processes.

One of the fundamental assumptions in Langmuir's theory is that adsorption is unimolecular. This assumption is not obeyed in Van der Waals adsorption, because this type of adsorption is usually multimolecular. In the literature of Van der Waals adsorption one finds five different isotherm types, only one of which obeys the Langmuir equation. In the last few years an equation has been developed by the author and coworkers for the Van der Waals adsorption of gases to include all five isotherms. The equation enables one to evaluate the surface areas and the average pore diameters of the adsorbents, as well as the heats

of adsorption; and the values obtained from the theory agree very well with the experimental results. The theory also predicts correctly the temperature dependence of adsorption. (The collaborators in this work were E. TELLER, P. H. EMMETT, W. EDWARDS DEMING, and LOLA S. DEMING).

Langmuir's other assumption is that the heat of adsorption is constant over the surface. This is obeyed only roughly in Van der Waals adsorption, but very seldom in chemisorption. Recently a theory of chemisorption was developed by the author and collaborators on the assumption that the heat of adsorption varies over the surface, and that the variation is proportional to the fraction of the surface covered by adsorbed gas. Equations were developed also for the rates of adsorption and desorption. The new equations fit very well the curves obtained 10 years ago for the rates of adsorption of nitrogen on iron catalysts. In the second place, they enable one to calculate the adsorption isotherm from the rates of adsorption, and excellent agreement was obtained between theory and experiment. Finally, from the same rate equation one can calculate the kinetic expression for the decomposition of ammonia over iron catalysts, and again excellent agreement was found with experiment. (The collaborators in this work were Miss K. S. LOVE and R. G. KEENAN.)

1200TH MEETING

The 1200th meeting was held in the Cosmos Club auditorium, Saturday, April 11, 1942, President BROMBACHER presiding. A paper on *Calibration of mercurial and aneroid barometers* was presented with illustrations and exhibits by Mr. D. P. JOHNSON, of the National Bureau of Standards. It was discussed by Messrs. H. L. CURTIS, MCCOMB, L. B. TUCKERMAN, PAWLING, P. A. SMITH, MEARS, STIMSON, and B. G. JONES.

Five years ago an accuracy of 0.1 mm of mercury was regarded as entirely adequate for the calibration of any portable aneroid or mercurial barometer. The recent development of aneroid instruments capable of measuring pressure changes equivalent to a three inch head of air has made necessary a corresponding improvement of the standards. At the same time, by using a sensitive aneroid to keep track of small pressure changes, it is possible to eliminate the uncertainty which results when readings of a number of instruments cannot be exactly simultaneous.

A normal barometer has been built which consists essentially of a U-tube of 20-mm bore, with one arm evacuated, a pair of telescopes for sighting on the mercury surface, and a scale. The uncertainty due to the capillary depression of the mercury meniscus in a U-tube of this size is about 0.01 mm of mercury and sets this limit to the accuracy attainable with the instrument. The system was therefore designed for ease and speed of reading, consistent with a sensitivity of 0.01 mm of mercury. A scale in the eyepiece of the telescope is seen superposed on the metal scale, forming a vernier which can be easily read to 0.01 mm. With proper illumination it is possible to set on the mercury surface more closely than the scale can be read. Corrections are applied for all factors which can be evaluated, including temperature, gravity, head of air between the standard and instruments tested, capillarity, and residual pressure in the evacuated arm. The room temperature is held constant for several hours before reading. With this instrument, pressure measurements can be made one minute apart, with an over-all accuracy believed to be better than 0.03 mm of mercury.

The president announced the program for a joint meeting with the Washington Academy of Sciences.

1201ST MEETING

The 1201st was a joint meeting with the Washington Academy of Sciences on April 16, 1942. Mr. Paul R. Heyl, of the National Bureau of Standards, delivered an address entitled *Cosmic emotion*, published in the August 1942 issue of this JOURNAL.

1202D MEETING

The 1202d meeting was held in the Cosmos Club auditorium, Saturday, April 25, 1942, President BROMBACHER presiding. An invited paper on *Diet in experimental cancer* was presented with illustrations by Mr. DEAN BURK, of the National Cancer Institute. It was discussed by Messrs. PAWLING, HUMPHREYS, P. A. SMITH, and H. L. CURTIS.

Studies of the past few years make it certain that various types of cancers may be influenced by dietary composition. As a general rule, even

if not invariably, the growth of tumors is affected by dietary factors in much the same manner as is the growth of the host animals. In particular, tumor growth can often be prevented if constituents essential for body growth are largely omitted from the diet. Studies on the influence of diet on the formation of liver cancers induced by the feeding of butter yellow (p-dimethylaminoazobenzene) to rats have been very illuminating in showing that a large array of factors may be involved. Some factors, such as riboflavin and protein (casein, egg albumen) are anti-carcinogenic and tend to protect against cancer formation. Other factors, such as biotin and inositol, have been found to be procarcinogenic, tending to promote tumor formation. Still other materials, including cystine, choline, and crude vitamin concentrates, are amphicarcinogenic, that is, they may act anticarcinogenically under one set of dietary circumstances, and procarcinogenically under a different set of conditions. Evidently both vitaminic and avitaminic factors are involved in the controlling dietary balance, and the interpretation of the data may also be made in terms of sulfur, nitrogen, and methyl groups concerned. Very little work has been directed yet toward distinguishing between dietary effects upon initiation as contrasted to growth and development of tumors, and most of the work has dealt with animal tumors, induced or spontaneous, primary or secondary. Application to human cancer of information obtained with animal tumors is largely a problem for the future but certain aspects are definitely under attack at present.

The president announced that the Joseph Henry Lecture would be presented in the fall.

1203D MEETING

The 1203d meeting was held in the Cosmos Club auditorium, Saturday, May 9, 1942, President BROMBACHER presiding. An invited paper on *The absorption spectra of some organic dyes* was presented with illustrations by Mr. A. L. SKLAR, of the Catholic University of America. It was discussed by Messrs. FOURT, DURAND, and BROMBACHER.

The assignment of the light absorption associated with the color of organic molecules to a non-Rydberg electronic transition involving the unsaturation electrons was discussed from chemical and physical viewpoints. Evidence was summarized for the view that the 2,500 Å band of benzene is associated with transition between the two molecular energy states which may be considered as arising from a resonance splitting of the two Kekule structures. The same idea was carried over to the polymethine dyes, in which the two most stable resonance structures (I_a and I_b) are the analogues of the Kekule structures.

The only differences in the two cases are first, that the two structures, I_a and I_b, do not interact directly, but only through a series of "intermediate" structures of higher energy in which the positive charge is on one of the carbon atoms of the chain; and, second, that the two structures, I_a and I_b, may, in unsymmetrical dyes ($R_1 \neq R_2$), have slightly different energies. This view was then used to explain the following observations[1]: the increase of peak wavelength with chain length n; the existence of a "deviation" to shorter wavelengths in unsymmetrical dyes when compared to symmetrical dyes; the increase of the "deviation" with n; the apparent existence of a convergence limit; the Brooker sensitivity rule, and the Schwartzenback rule.

The president announced the election of the new Committee on Communications as follows: Messrs. K. F. HERZFELD (chairman), LAWRENCE WOOD, and PETER COLE. He announced that this would be the last meeting of the season.

FRED L. MOHLER, *Recording Secretary.*

[1] L. G. S. BROOKER and coworkers. Journ. Amer. Chem. Soc. **62**: 1116; **63**: 3129, 3203, 3214; **64**: 199.

Obituaries

CLINTON HART MERRIAM, who was an active spirit in the organization of the Washington Academy of Sciences when it was being founded toward the close of the last century, died quietly on March 19, 1942, after several years of failing health, at Berkeley, Calif., in his 87th year. On account of his life of high achievement along zoological and anthropological lines, not only has the Academy but all students interested in these and kin-

dred subjects lost a leader who set a pace well worthy to follow.

Dr. Merriam was born in New York City on December 5, 1855, son of Clinton L. Merriam and Caroline Hart Merriam. His interest in natural history began early in life, and it broadened in scope and matured in character as time went on. In 1872, and in his 17th year, he became naturalist of the Hayden Survey, which made explorations of the Yellowstone area. In 1874 he entered Sheffield Scientific School of Yale, and completed the course in 1877. While there he wrote his *Review of the Birds of Connecticut*, a very creditable piece of work.

He graduated from the College of Physicians and Surgeons, of New York, in the Class of 1879. On March 7, 1878, he assisted in founding the Linnaean Society of New York, and was elected its first president. During the years 1879 to 1885 Dr. Merriam built up a good medical practice at his home in Lewis County, N. Y.

During the spring of 1883, as surgeon of the sealing vessel *Proteus*, he visited the ice fields off the coast of Labrador and Greenland, to make a study of the hooded seals. He brought back valuable records and many specimens. In the autumn of the same year he joined with 22 others in founding the American Ornithologists' Union and was elected secretary, and during 1900–1902 he was its president. In 1885 he became chief of the Division of Ornithology, United States Department of Agriculture, which was the forerunner of the Biological Survey and, at present, the Fish and Wildlife Service. During the 25 years Dr. Merriam was chief, he planned and carried out a number of field expeditions to obtain data on life zones, distribution of animal and plant life, laws of temperature control, and geographic distribution of life. Among these may be mentioned the Biological Survey of San Francisco Mountain and Desert of the Little Colorado River, Arizona; Biological Reconnaissance of Idaho; Death Valley Expedition; and Biological Survey of Mount Shasta, California.

While Merriam was on the Death Valley Expedition in 1891 President Harrison appointed him a member of the U. S. Bering Sea Commission, to study fur-seal conditions on the Pribilof Islands.

The vast number of mammals collected by members of the Biological Survey enabled him to describe many new species, of which 651 type specimens are in the National Museum collections. He also monographed the pocket gophers, shrews, weasels, and the grizzly and big brown bears.

Dr. Merriam had considerable to do in planning the personnel and route of the Harriman Alaska Expedition, with Dr. Lewis R. Morris, physician of Mr. Harriman, and member of the Boone and Crockett Club. On the return of the expedition he devoted much time to editing its publications. In consideration for his untiring services, Mrs. E. H. Harriman established a special trust fund to enable him to carry on research work, which after retiring from the Biological Survey in 1910 he devoted largely to the linguistic studies of California Indians. During the years 1917 to 1925 Dr. Merriam was chairman of the United States Geographic Board.

Among the scientific societies and clubs in which he held membership the following may be mentioned: American Ornithologists' Union, Linnaean Society of New York, National Academy of Sciences, Washington Academy of Sciences, Boone and Crockett Club, Cosmos Club, American Society of Naturalists, Biological Society of Washington, American Philosophical Society, American Society of Mammalogists, Anthropological Society of Washington, and Zoological Society of London. In a number of these he was among the founders, and of a majority of them he was president at one time or another.

As author or editor he always endeavored to obtain exact facts, so that his 500 or more publications went through the most careful scrutiny before they were ready for publication. He helped many with editorial suggestions, and there are some reports that never would have seen the light of day had he not given much time to editing and revamping crudely prepared notes or manuscripts. Merriam was a man of many friends and admirers, and through his publications and advocacy he helped scores of ornithologists and mammalogists with their problems.

In science, as in other lines, there are contemporary waves where groups of individuals interested in similar problems associate together for a better understanding and ad-

vancement of their vocation or hobby. In the case of Dr. Merriam, he was one of the last to join his zoological contemporaries who passed beyond before him. The group of naturalists to which Dr. Merriam belonged was indeed a distinguished one, but none made a greater contribution than he to the natural history of America, and none will be remembered with more affection.—A. K. FISHER.

ANDREW STEWART, born in Washington, D. C., on September 3, 1867, died on June 28, 1942, in his home at 1442 Clifton Street, Washington, D. C., after an illness of a year. Through his departure science lost a devotee; the Nation lost a citizen of intense loyalty; several cultural and patriotic organizations lost a leader and historian; and a household that typifies the finest of American home life lost a loving husband and father.

The Stewart family descended from Scotch and English lines that have been traced to the Royal House of England. In America they have long been prominent in the affairs of southwestern Pennsylvania and the Nation's Capital. Stewart's grandfather, the Honorable Andrew Stewart, for whom he was named, served Pennsylvania as a member of Congress for 18 years and gained the nickname of "Tariff Andy" through his continuous and successful advocacy of the protective tariff. He was also one of the initiators of the Chesapeake and Ohio Canal. David Shriver Stewart, father of the subject of this obituary, served in Washington as the chief of a division of the Patent Office.

The culture, sincerity, and patriotism derived from a background of ancestors who had served with distinction in the Revolution, the War of 1812, and the Civil War were reflected in Stewart's character. He graduated from Central High School where, because of high scholastic standing and proficiency in military drill, he was made first commanding officer of the cadets, holding the rank of major. After graduation he studied chemistry in Germany, and in 1895 he received the degree of doctor of philosophy, cum laude superato, at the University of Leipsig.

In 1895 Dr. Stewart returned to the United States and served for a short time in the "poison squad" of the Bureau of Chemistry, Department of Agriculture, under the late Dr. Harvey W. Wiley. Next, he conducted research on chemical synthesis for Sharp & Dohme. From 1897 to 1900, he and the late Dr. George W. Johnston established and conducted a chemical analytical laboratory, which was a pioneering project in that field in Washington. He lectured on this subject at the National Veterinary College and the Medical Schools of the George Washington and Georgetown Universities, and was associate editor of the National Medical Review. In 1902, he entered the Dendro-Chemical Laboratory of the Bureau of Chemistry, Department of Agriculture, and from 1903 to 1905 was in charge of that laboratory.

After a period spent largely in writing and the management of family estates, Dr. Stewart entered the Bureau of Mines in 1918, serving in the Division of Mineral Technology, which then conducted the Bureau's work on helium. As a result, he played a prominent part in pioneering work that led to important developments in later years. In 1925, when a Helium Division was organized in the bureau to handle the development and operation of helium plants to supply the Army and Navy, Dr. Stewart was made assistant to the chief of the division, and served in that capacity until he retired in 1933. He was a member and secretary of the Interdepartmental Patents Board.

Among his many publications was one entitled *About Helium*, which was written to present information to the layman concerning the history, properties, production, and uses of helium. This pamphlet is one of the most widely read of the Bureau of Mines' publications.

Dr. Stewart was a prominent member of the Sons of the American Revolution and the Society of Colonial Wars. From 1934 to 1938, he was vice-president general of the General Society of the War of 1812, and served the District society at various times as president, first vice president, registrar, and historian. In Masonic circles, he was past master of Harmony Lodge No. 17, a 32d degree Mason, and a member of the Shrine. He was a member of the Washington Academy of Sciences, the American Chemical Society, the American Association for the Advancement of Science, and the Cosmos Club.—R. A. CATTELL.